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ECONOMIC DETERMINANTS OF RESIDENTIAL MORTGAGE CHOICE

by

Marvin J. Horowitz

A dissertation submitted in partial fulfillment of the
requirements for the degree of

DOCTOR OF PHILOSOPHY
in
URBAN STUDIES

Portland State University

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TO THE OFFICE OF GRADUATE STUDIES AND RESEARCH:

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Title: Economic Determinants of Residential Mortgage Choice.

APPROVED BY MEMBERS OF THE DISSERTATION COMMITTEE:

Anthony M. Rufolo, Chairman

Morton Paglin

Kuan-Pin Lin

James Strathman

Variable rate mortgages (VRMs) have been introduced into the mortgage market as a means of addressing the

housing finance problems encountered over the past two decades. To learn more about the demand for VRMs, this study analyzes borrower choice behavior and its economic determinants. In order to estimate the probability of borrowers choosing VRMs rather than conventional fixed rate mortgages, discrete choice (logit) models are specified and validated for both cross-section and pooled time-series cross-section data samples. These samples contain mortgage application information for the years 1978 through 1981. They were drawn from the Loan Register Report of the California Department of Savings and Loan. The probability of choosing a VRM is estimated as a function of selected price components of the mortgage instrument, borrower characteristics, and economic expectations.

CHAPTER I

INTRODUCTION

Inflationary pressures of the past two decades have precipitated sweeping changes in business institutions and business procedures. One of the sectors of the economy that has undergone major evolution has been the financial sector, particularly banking. Inspired by inflation's impacts, since the late 1960's scores of new savings and investment instruments have worked their way on to the market. By successfully competing for funds these opportunities helped underscore the inefficiency and lack of flexibility that banking regulations promulgated, leading to the banking deregulation movement which we are in the midst of currently.

One of the financial instruments that puts lending institutions most at the mercy of inflation is long-term fixed interest rate mortgages (FRMs). When funds are loaned for periods of twenty to thirty years at a fixed nominal interest rate, unanticipated upward interest rate movements have a serious impact on the profitability of existing investments. Rising interest rates benefit borrowers with existing loans in that these loan costs remain below the new cost of funds; conversely, they harm lenders, whose new costs of funds exceed their existing

investment revenues. As inflation's effect is to raise nominal rates, lenders of long-term mortgages are thus openly exposed to financial risk in inflationary periods.

To offset this exposure a host of alternative mortgage instruments have been marketed by lenders since the mid 1970's. One of these, variable interest rate mortgages (VRMs), has become especially popular with lenders and borrowers. These mortgage instruments differ from the standard fixed rate mortgage instruments in that the interest rate of these loans, and hence the borrower's monthly payment schedule, is adjusted periodically to reflect the changing cost of funds to the lender.

The focus of the present research is mortgage choices and their determinants. Specifically, this research addresses itself to that mortgage instrument, VRMs (also known as adjustable rate mortgages or ARMs), which has gained the most popularity in recent years. VRMs have the longest and most extensive history of all alternative mortgage designs, and they promise to be the alternative mortgage most likely to compete with FRMs in the future. According to a survey conducted in 1982 by the American Mortgage Insurance Company, sixty-two percent of the savings and loan associations (S&Ls) polled offered VRMs in the month of September, as opposed to thirty-seven percent surveyed one year earlier (Colton, 1983). More recent reports confirm the growth of this trend. For example, the Federal Home Loan Bank Board is reported as stating that

VRMs made up fifty percent of single-family conventional loans in October 1983 - double the percentage accounted for a mere three months earlier (Wall Street Journal, 1983). No other alternative mortgage instrument has come close to this record.

What explains the popularity of these mortgage loans among borrowers? Does the initial rate at which the loan is issued, or other "pricing" features of the loan, influence the borrower's decision to accept a VRM? If so, how strong might that influence be? Answers to these questions continue to be sought by financial and regulatory institutions. Additional questions, such as whether the socio-economic characteristics of borrowers or the economic climate influence the choice of mortgage loan, also remain unanswered at this time. These questions are timely and have a direct bearing on the health of the lending industry, the housing industry, and the national economy.

At present, little is known about the future acceptance of VRMs or about the specific factors that may influence the magnitude of its acceptance. The reasons for this absence of knowledge are practical ones. VRMs have not been widely available for very long, making historical data scarce. Also, privacy regulations and lack of coordination among individual lending institutions make research projects requiring large scale record retrieval difficult.

This study explores the demand for VRMs in the

California mortgage market in the years 1978 through 1981. Using microdata provided by a unique data base known as the Loan Register Report, loan application information from mortgage borrowers is analyzed. Combined with supplemental economic data, this information affords the opportunity to explore the effective demand for VRMs. After developing a model based on the economic theory of utility-maximization to explain the probability of borrowers choosing a VRM, statistical models are estimated in order to quantify the "probabilitity" of borrowers choosing VRMs rather than FRMs. These estimates incorporate the influence of mortgage pricing factors, borrower characteristics, and economic expectations. In addition, estimates are derived of the changes in the choice probability due to changes in selected variables.

Before developing the mortgage choice model a brief history of the emergence of alternative mortgage instruments is provided, and the literature related to mortgage choice is reviewed.

CHAPTER II

BACKGROUND:
THE EMERGENCE OF ALTERNATIVE MORTGAGE INSTRUMENTS

Since the 1930's, the vast majority of housing purchases in the United States have been facilitated by long-term, fixed-interest-rate, fixed-payment mortgages. Standard fixed-rate mortgages were developed at a time when the typical features of a home mortgage loan were a low loan-to-value ratio and a "balloon" payment to be paid at the end of a term usually lasting less than ten years. In order to increase homeownership, an explicit goal of federal policy, the Federal Housing Administration (FHA) encouraged the use of FRMs. The instrument served to accomplish this goal by reducing downpayment requirements and spreading the borrower's repayment of interest and principal over a longer period of time.

FRMs served their purpose well not only for borrowers. Lenders too discovered that FRMs met their needs. Irrespective of the introduction of FHA insurance intended to protect lenders against the risk of default, lenders found long-term, high loan-to-value, self-amortizing loans profitable. However, in order to remain profitable, these loans required stable economic conditions - specifically, little unanticipated upward

movement in inflation.

Since 1965 when inflation began to act unpredictably, lender disenchantment with FRM's has grown increasingly strong. In principle, if future short-term interest rates rise beyond expectations, outstanding long-term fixed-rate loans can impose permanent losses on lenders. Financial intermediaries borrow short and lend long, which is to say that the return on their assets is tied into long-term interest rates while their liabilities are determined by short-term interest rates. As a result, when interest rates rise an asset maturity/liability imbalance occurs in which lenders pay more for their new funds than they receive in revenue from their old assets. Thus, besides incurring the usual investment risks associated with changing asset values, inflation heightens a second risk factor associated with investments, interest rate risk. Alternatively, in principle FRMs can impose permanent losses on borrowers when future short-term interest rates fall below general expectations. This is because borrowers would be making payments at the original interest rate, one which exceeds the cost of new funds.

Despite the apparent risks, until recently losses of these sorts have generally been avoided by both parties. Borrowers have been insulated from serious risks through the prepayment provision of mortgages, whose penalties are usually slight. With refinancing as an option, borrowers incur relatively minor losses. These stem primarily from

the extra transactions and time costs involved in refinancing. From the lender's perspective the borrower's perogative presents them with a no-win situation since the possibility of windfall losses is unavoidable, while the possibility of windfall gain is remote. Contract provisions enabling lenders to renegotiate mortgage loans with borrowers have generally not been part of the conventional mortgage instrument.

Yet, lest it appear that lenders faced inordinate exposure to interest rate risk, it should be noted that historically lenders received an indirect form of protection. Government-imposed interest rate ceiling regulations, by stifling competition, kept the cost of funds to lenders at low and stable levels. This protection was a mixed blessing, however. Though lenders were shielded from higher costs, interest rate ceilings also encouraged savers and investors to withdraw their funds from conventional bank accounts and deposit them instead into unregulated accounts where yields were higher. This process, known as disintermediation, caused the earnings of many lending institutions to plummet, leading more than a few of them into bankruptcy or merger.

Without the protection of interest rate ceilings, the need for new types of mortgage instruments has become especially pressing for lenders. Not surprisingly, in the past ten years financial institutions have been made aware of other inherent shortcomings in the standard mortgage.

Besides the stresses caused by underestimating the level of future interest rates, lenders of fixed-rate loans can face cash-flow difficulties when short-term rates are temporarily high. The interest rate charged for a long-term loan under these circumstances would normally be below the current interest rate, because future rates would be expected to decline. Hence, in the early part of the term a revenue shortfall would prevail even though total revenues generated throughout the entire term of the loan may equal the cost of capital over the entire term. This situation, though uncommon, has occurred in recent years. Here again it should be noted that lenders enjoy a modicum of protection against risk through their abilities to build up reserves, borrow on the capital markets, or otherwise hedge. These protections are limited, though, by regulatory and market constraints, and they are costly.

In a corresponding way, the recent inflationary periods have adversely affected mortgage borrowers, too. Disintermediation, caused by the combination of rising interest rates and interest rate ceilings, was largely responsible for the wide fluctuations in the availability of housing finance funds experienced over the past decade and a half.

Another problem for borrowers in inflationary periods has been termed the "tilt effect". As inflation and nominal interest rates on mortgage loans increase, the match between household income and mortgage payments

becomes increasingly misaligned. Since conventional mortgages require level or equal nominal payments over their entire terms, future inflation causes a decline in the real, or "inflation-adjusted", pattern of payments. In order to offset this decline, lenders must demand higher nominal payments in the earlier years of the loan. This results in a downward tilt in the stream of real mortgage payments from the start to the end of the term of the loan. The effect of this tilt is to make housing payments especially burdensome during the first years of the mortgage, at a time when many households, particularly young ones, can least afford it.

One solution to the tilt problem is alternative financing such as second mortgages and consumer credit. However, no matter how the cash-flow problem is ameliorated, be it by alternative financing, lower downpayments, postponement of purchasing, or shifts in the quantity/quality of the housing acquired, there is little doubt that during inflationary periods this tilt effect of conventional mortgages imposes added costs on borrowers. It should be noted though, that the tilt effect has at least one beneficial side effect - it accelerates the accumulation of borrower equity. As borrower equity is a major determinant of default risk, tilt may make possible the issuance of mortgages of high loan-to-value ratios that are of no greater risk than lower loan-to-value mortgages during periods of low inflation.

Responding to the economic conditions of the past twenty years with the recognition that increased mortgage instrument choice could improve credit market functioning, the lending industry gradually introduced innovative loan instruments into the residential mortgage market. Regulatory constraints and legal obstacles notwithstanding, some states, most notably California, have allowed lending institutions to experiment with alternative mortgage instruments. Not long ago, the Comptroller of the Currency, the National Credit Union Administration, and the Federal Home Loan Bank Board adopted regulations authorizing federally-chartered depository institutions to deal in alternative mortgage instruments. This movement culminated in the enactment by the U. S. Congress of the "Alternative Mortgage Transaction Parity Act of 1982", Title VIII of the "Garn-St Germain Depository Institutions Act of 1982", which asserts the following:

> Alternative mortgage transactions are essential to the provision of an adequate supply of credit secured by residential property necessary to meet the demand expected during the 1980's. (p. 1545)

The purpose of this legislation is to provide non-federally chartered housing creditors parity with federally chartered institutions. This legislation authorizes "all housing creditors to make, purchase, and enforce alternative mortgage transactions so long as the transactions are in conformity with the regulations issued by the Federal agencies" (p. 1545). In sum, this legislation paves the

way for an unlimited variety of new types of mortgage instruments to be offered by lenders nationwide. Currently, the potential combinations and varieties of mortgage features are almost unlimited. Only the lender's imagination and the consumer's desire restrict the choices.

Alternative mortgage instruments now being offered are essentially of two types. Graduated payment mortgages (GPMs) are distinguished by installment schedules which call for larger and larger payments as time goes on. One relatively common variety of GPM is the deferred interest mortgage (DIM). It allows for negative amortization of the loan, providing for lower initial payments than on similar standard mortgages. The unpaid nominal interest is added back to the principal balance and is offset by higher payments later in the term. Another variation on the graduated payment mortgage, the growing equity mortgage (GEM) does not involve negative amortization but rather a shortening in the term of the loan as the payments increase.

The second basic alternative mortgage instrument design is the variable rate mortgage (VRM). This type of mortgage ties the loan's interest rate to a selected financial market interest rate, called a "reference rate", which is supposed to reflect the real costs of funds for the lender. The frequency with which the interest rate on the mortgage is adjusted to the reference rate, as well as some of the other specifics of the loan such as whether or

not limits exist on the extent of the interest rate adjustment, varies with the institution offering the loan and the regulatory and statutory environment.

Despite the fact that these two designs are the ones most widely used as alternatives to the standard fixed-rate mortgage, neither solves all the problems inherent in the FRM. GPMs provide potential relief for the tilt and cash-flow problems home buyers confront, but do nothing to relieve the liquidity problems that lenders face. On the other hand, the VRM design helps lenders shift interest rate risk to borrowers but does not directly address or alleviate the tilt problem. Though VRMs may reduce borrowers payments by allowing for initially lower interest rates and by perhaps encouraging lower inflation premiums, these benefits will generally not be sufficient to greatly offset the payment tilt.

In light of these limitations a number of more elaborate designs have been proposed. For example, the price level adjusted mortgage (PLAM) features a mortgage composed of a "real" rate of interest that is fixed, and a price index which is used to adjust the size of the principal to inflation. Another design, the constant payment factor VRM (CPF-VRM), a hybrid of the GPM and VRM, also involves two separate rates, i.e., a debiting factor for calculating the outstanding balance and a payment factor used to recompute the future periodic payments. These instruments address the problems of borrowers and

lenders simultaneously, but they are also more complex and pose new types of risks and uncertainties. Thus, these instruments remain relatively unpopular at the present time.

Amidst this wide variety of alternative mortgage instruments now available in the mortgage market, the one most competitive with FRMs is clearly the VRM. There are several reasons why this is so. From the borrower's perspective, VRMs are the instrument most similar to the conventional FRM. With the exception of a provision calling for periodic interest rate adjustments, VRM features can be identical to those of the FRM. This means that borrowers need not be concerned with a host of unfamiliar complexities, such as the conditions under which negative amortization occurs. Rather, VRM borrowers face mortgage features that parallel those of the conventional mortgage instrument.

Adding to its attractiveness to borrowers, the initial interest rate on VRMs is usually below comparable FRM rates. Because VRMs provide lenders with interest rate protection, it is in lenders' interest to encourage borrowers to accept VRMs. Often, this encouragement takes the form of offering borrowers lower initial interest rates. The advantages of relatively conventional features and interest rate discounts combine to make VRMs more marketable than other alternative mortgage instruments.

In summary, the emergence of VRMs has largely been due to the inflationary conditions of the past twenty years. These economic pressures, coupled with innovations in financial markets, made painfully clear the inadequacies of fixed-rate mortgage financing. In response, lending institutions were given permission by regulatory agencies to develop new forms of mortgage instruments. To date, the most popular of these new instruments has been the VRM. By allowing for periodic adjustments to the interest rates of long-term loans, VRMs shift some interest rate risks from lenders to borrowers. In doing so, VRMs help break the "lend-long and borrower-short" syndrome that caused financial difficulties for lenders. By providing another means for lenders to restructure their portfolios, these instruments are viewed as helping to ensure the viability of lending institutions and hence, the housing finance market.

CHAPTER III

REVIEW OF THE LITERATURE

The economics of housing is one of the major interests in the field of urban economics. In the study of housing, three topics have captured the largest share of research effort. These are: 1) estimation of the income elasticity of demand for housing services and the price elasticities of demand and supply; 2) the degree of racial segregation and discrimination in the housing market and its implications for housing quality and prices as well as job opportunities; and 3) the influence of intra-urban location on variations in housing prices (Struyk, 1976). Of course, within each of these areas a significant amount of research and analysis has focused on examining the impact of federal, state, and local government laws and regulations.

Recent research in the economics of housing has taken a new twist. The unpredictable economic cycles of the past decade and unexpectedly high inflation have shifted attention to the topic of housing finance. Several important subjects are contained within this topic. These include the functioning of the secondary mortgage market and its interrelationship with the primary market, the impact of banking regulations such as Regulation Q on the

availability of mortgage funds, and the influence of monetary policy on the cost of mortgage funds. What gives these diverse finance and banking subjects something in common with the economics of housing is that they each have a significant impact on one of society's greatest concerns, housing "affordability".

Beginning in the latter half of the 1960's with the onset of higher and higher levels of inflation, it appeared to many that adequate housing was becoming increasingly difficult to purchase for a large number of households. Several seemingly ominous developments appeared simultaneously to nurture this belief. These were the apparent erosion of consumer purchasing power, the rise in the costs of new home construction and housing upkeep and operation, and the increased price of mortgage finance.

Many prominent economists and government officials viewed the conventional mortgage financing method - its effects on both lending institutions and borrowers - as the major contributor to the problem of housing affordability (Poole, 1972; Tucker, 1975; Lessard & Modigliani, 1975; Hendershott & Villani, 1977). In a call for immediate action, Frank E. Morris, president of the Federal Reserve Bank of Boston summed up these views:

> After a decade of failure it is time to turn away from makeshift responses to the problem of housing finance and begin to seek fundamental answers. These answers, it seems to me, lie in the restructuring of the mortgage instrument. (Morris, 1975, p. 9)

This advice has since been heeded.

In the past decade the research activity devoted to studying new mortgage instruments has indeed been impressive. Prominent among the research conducted is a series of investigations initiated in 1976 by the Federal Home Loan Bank Board (FHLBB). Called the Alternative Mortgage Instruments Research Study (AMIRS), this project culminated in the publication, in three large volumes, of the findings of twenty different studies. Together they cover almost the entire spectrum of issues surrounding alternative mortgage instruments (Kaplan, 1977).

One of the issues investigated in the FHLBB project was borrower acceptance of alternative mortgage instruments. Two studies involving VRMs specifically addressed this topic. A more recent study, a Harris poll conducted for the Federal National Mortgage Association (FNMA), also looked into borrower attitudes towards and knowledge of alternative mortgage instruments. Four more studies, two of which are AMIRS efforts, simulated alternative mortgage instrument demand using an assortment of assumptions and data bases.

In the first AMIRS study of borrower acceptance, attitudes towards and preferences for various types of alternative instruments were surveyed by telephone and mail (Colton, Lessard, & Solomon, 1979). The main findings identified young renter households, particularly those in lower income brackets with expectations of rising incomes,

as amenable to GPMs. Less clear were the findings for VRMs. Moderate receptivity to alternative instruments and a preference for GPMs was also found in the focused group discussion study conducted for FNMA (Louis Harris & Associates, 1982) in which twenty-nine percent of the participants found the GPM to be the most attractive of all alternative instruments, and only sixteen percent preferred VRMs.

The second FHLBB borrower acceptance study (Albaum & Kaufman, 1977) is also a survey, this time of actual borrowers. It presents data gathered from VRM and FRM households in California. In addition to collecting social and economic household characteristics, this study investigated household perception and knowledge of the various mortgage instruments, satisfaction with the respective mortgage plans, and the process undergone to obtain residential mortgages. Interesting though the findings of this study are, the authors caution that they must be interpreted in light of the fact that VRMs had been widely introduced in California for less than two years. Also, up through the completion of this study, California borrowers of VRMs had yet to have the interest rates on their loans adjusted from their initial rates.

Regarding borrower characteristics, Albaum and Kaufman found moderate differences between VRM households and households who borrowed FRMs after VRMs became widely available. Ethnicity, age, sex, formal education level

achieved, employment status, and income were similar across borrowers, as was the distribution of the number of children living at home at the time of mortgage acquisition. However, marital status seemed to differ between groups. Divorced people were relatively more prominent among VRM borrowers, whereas people who had never been married were more prominent among FRM borrowers.

Both the income status and the total value of financial assets differed among borrowers. A significantly higher percentage of VRM borrowers had annual incomes of $15,000 or less, and the average value of the financial assets of VRM borrowers was roughly eighty-one percent that of FRM borrowers. Consistent with these results it was found that occupations differed between borrower groups and that various mortgage terms differed between groups too. For example, VRM borrowers purchased homes whose prices were eighty-three percent those of FRM borrowers.

Briefly, the remaining findings indicated that borrowers encountered no real problems in understanding or being aware of the features of VRMs, that the traditional features of mortgages such as interest rates and closing costs were considered more important to most borrowers than secondary features such as guaranteed transferability, that most borrowers viewed VRMs somewhat less favorably than FRMs, and that all groups of borrowers were inclined to shop for mortgages.

The scarcity of actual data on borrower acceptance and

use of alternative mortgage instruments has led researchers to try to predict mortgage demand based on simulations of future conditions. In general, these studies are of limited value because of their dependence on restrictive assumptions, such as that alternative moortgage instruments will replace rather than supplement FRMs, that mortgage terms are determined exogenously through separate supply functions, and that the structural relationship between household income and expenditures is not altered with the introduction of new mortgage instruments (Vandell, 1978). Further, these studies rely on projections based on unchanging institutional constraints and simplified extrapolations of household income streams and mortgage payment burdens. They largely ignore equity accumulation, changes in household size and age composition, earnings mobility, and other socio-economic variables of likely importance in determining future tenure patterns and mortgage choices.

Among the simulation studies of borrower acceptance, the two earliest were for the AMIRS project. In a study of the "potential" demand for alternative mortgage designs (Smith, Wiest, & Field, 1977), households sampled from a national survey were grouped by demographic and income characteristics. After simulating the future household payment-to-income ratios for three types of alternative mortgage instruments estimates were made of the potential demand for these mortgages. Based on household ability to

carry the mortgages the findings indicated that alternative mortgage instruments could increase homeownership by somewhere between one-and-one half and five percent in the economic climate prevailing at that time. The likeliest of borrowers were young renters and owners with lower than median incomes.

Whether the widespread use of alternative mortgage instruments can have a significant influence on the ability of moderate income families to own homes was one of the main questions posed by another study initiated by the FHLBB (Follain & Struyk, 1977). Here, the effects of several different alternative mortgage instruments were simulated using various region-specific assumptions regarding rates of income and population growth, price increases, and property appreciation. The findings were of substantial increases in homeownership rates, particularly for low-income households. Further, homeownership rates differed depending upon the mortgage instrument considered.

A final simulation study (Vandell, 1978) again projected potential housing consumption and credit usage given alternatives to FRMs. Exploiting the information contained in an empirical model estimated with FRM data, Vandell's simulations indicated that GPMs and PLAMs can significantly increase housing and mortgage credit usage without adverse distributional effects across households. VRMs, however, were predicted to perform worse than all other instruments, including FRMs, both with respect to

homeownership and credit usage and the distributional consequences for low-income, young, elderly, and black households.

Willingness on the part of consumers to pay a premium for obtaining a certain type of mortgage, and conversely, willingness on the part of lenders to offer a premium to consumers who opt for certain types of mortgages, reflects the relative desirability of the instruments to each party. This desirability, expressed as financial concessions, is an important determinant of mortgage choice.

As VRMs are instruments that shift interest rate risk from lenders to borrowers, more than any other alternative instrument they serve the needs of lenders best. Because of this, and because VRMs are the one instrument featuring a price, i.e., an interest rate, that can be adjusted periodically, they have been the focus of several studies exploring the issue of mortgage pricing and financial concessions. In essence, these studies explore how the pricing of the riskier VRMs relative to safer FRMs encourage borrowers to accept the one rather than the other.

The most common analytical and simulation approaches to exploring VRM pricing employ the yield curve concept in explaining how relative interest rates are determined. The yield curve represents the relationship between interest rates and the remaining term to maturity of investments in

the same general risk category. Under normal conditions the shape of this curve is positively sloped, reflecting interest rate risks and expectations, and liquidity preferences.

Using the logic of the yield curve to explain how the interest rates on VRMs are related to those on FRMs, many researchers have concluded that VRMs, ceterus paribus, are likely to be priced below FRMs (Poole, Opper, & Taylor, 1972; Kaufman, 1973; Cassidy & McElhone, 1975; Jaffee 1975; Jaffee & Kearl, 1975; Follain & Stryuk, 1977; Van Order, 1982). Generally, the expected interest rate spread between the instruments will result from FRMs being priced at the high or long-term end of the curve, while VRMs are be priced at the low or short-term end. The inequality between the two interest rates, and corresponding lender and borrower preferences, lead to the hypothesized price differential.

Several closely related approaches to the yield curve concept of pricing also lead to the conclusion that VRMs would carry lower interest rates than FRMs. In an extensive AMIRS analysis of mortgage pricing (Cassidy & Field, 1977) four hypotheses besides the yield curve concept are identified and discussed. These are: 1) shifting of risk; 2) inflation hedge; 3) portfolio diversification; and, 4) normal profits hypotheses.

The "shifting of risk" hypothesis is typified by two studies (Von Furstenberg, 1973; Findlay & Capozza, 1977) in

which it is argued that because VRMs transfer interest rate risk from lenders to borrowers, borrowers will require a discount to be induced to accept VRMs. Similarly, the "inflation hedge" hypothesis focuses on inflation expectations and implies that because VRMs protect lenders against unanticipated inflation, they allow lenders to offer them at lower rates than FRMs. The third hypothesis, "portfolio diversification", argues that lenders' abilities to diversify their portfolios using VRMs will enable them to pass on efficiency gains to borrowers in the form of lower interest rates. Finally, the "normal profits" hypothesis argues that VRMs will result in an increased supply of mortgage funds, thus driving its interest rate downward relative to FRMs.

Data on the actual pricing of mortgage instruments is sketchy. Those studies reporting pricing differentials for FRMs and VRMs had little opportunity to observe interest rates under disparate economic conditions or to observe market responses to large rate adjustments. Nor had they the opportunity to relate these differentials to other price components of the mortgages.

These caveats being noted, it is nevertheless interesting to find that the available evidence tends to confirm, if weakly, the conclusions of the theoretical studies. In California, where VRMs had been offered since 1975, indications were that initial rates for VRMs were priced at or marginally below FRM rates (Riedy, 1976;

Albaum & Kaufman, 1977; Zabrewski, 1977). In sixteen states, including California, offering VRMs and other types of adjustable mortgages, a 1976-77 survey found that average discounts per state ranged from zero to thirty-five basis points, with an overall discount average of twenty basis points (Cassidy & Field, 1977). This survey also found average rate differentials to vary with the rate adjustment frequency and the reference rate or index used to adjust rates.

To briefly summarize, at the present time the literature on alternative mortgage instruments indicates that much has yet to be learned about the conditions surrounding borrower acceptance of VRMs. Based on a handful of surveys and simulation studies, it appears that VRMs have the potential to compete with the conventional fixed-rate mortgage instrument. However, the degree of borrower acceptance and the determinants of their acceptance remain open questions. Only one aspect of VRM acceptance appears evident. This is, that the pricing of VRMs relative to FRMs is critical to its competitive position. Numerous analytical studies of VRM pricing agree that an interest rate spread between instruments is expected. This conclusion is supported by what little actual data has been available.

In the following chapters an attempt will be made to arrive at more precise estimates of the determinants of

borrower mortgage instrument choice. After developing a theoretical model of mortgage choice, empirical data for a four year period will be used to quantify behavioral relationships between mortgage price components, borrower characteristics, economic expectations, and the probability of borrowers choosing VRMs rather than FRMs. This study is thus intended to fill in many of the gaps in our knowledge of VRM acceptance.

CHAPTER IV

THEORETICAL MODEL OF MORTGAGE CHOICE

The Theory of Utility-Maximization for Discrete Choices

Economic theory provides a model of rational consumer behavior in which an individual decisionmaker maximizes personal satisfaction subject to a rule of tastes or "utility function". In general, this theory requires that for individual satisfaction or utility-maximization to be achieved the consumption choices faced by the individual must be part of a continuum of alternatives. Formally, a decisionmaker has a utility function

$$u_i = U_i(x_i, e_i)$$

where x is a vector representing the characteristics of a consumption good, and e is a vector containing unobserved attributes of the decisionmaker such as experience, intelligence, and other factors that may influence taste. Also, the vector e may contain random factors that influence choice, as well as unobserved characteristics of the good itself, such as an implied guarantee of quality. This utility function is maximized subject to an individual's limited income, the condition known as the budget constraint, B. With P representing prices, utility-maximization subject to the budget constraint yields a demand function, h, such that

$x_i = h_i(B_i, P, e_i)$.

Within this decision-making framework the demand for a particular good having two or more discrete sets of characteristics can not be handled easily. The conventional framework for explaining consumer demand deals primarly with homogeneous, divisible products. By aggregating individual demand functions for a product of this type a market demand function is constructed. Variations in demand, when the quantity demanded is not zero, are then usually viewed as reflecting either random error or variations in choices at the intensive margin, i.e., at the border between more or less of an alternative. In contrast, consumer choice problems in which a good has two discrete sets of alternatives involve distinct yes/no decisions rather than incremental ones. These choices involve decisions made at what is termed the extensive margin.

To cope with discrete choice problems, theoretical models have been developed whereby the probability of an individual choosing a discrete alternative is explicitly accounted for by the effects of differences in individual tastes or decision rules. McFadden (1974) adapted the classical model of utility-maximization for discrete or "qualitative" choices by describing the mathematical properties of a model in which an individual has a utility function such as $u = U(x,z,e)$. The vector z in this formulation represents observable characteristics of a

given decisionmaker. With the decisionmaker or individual facing J discrete alternatives, indexed j = 1,...J and represented by vectors of attributes x_j, the individual's utility function is viewed as

$$U_i = V(x_j, z_i) + e_i(x_j, z_i)$$

where V stands for the "representative" tastes of the population and is nonstochastic, and e is stochastic and reflects the unique tastes of the individual for the alternative with attribute x. Using this model McFadden shows that the probability that the individual will choose alternative i if this is the utility-maximizing choice, is given by

$$P_i = \text{Prob}\,[e(x_j,z) - e(x_i,z) < V(x_i,z) - V(x_j,z) \quad \text{for } j \neq i].$$

This choice "probability" (in which ties are not permitted) can be viewed more simply by dropping the random effect e and defining the utility function as u = U(x,z). Then, the individual will maximize utility and choose alternative i if

$$U(x_i,z) > U(x_j,z) \quad \text{for all } j \neq i.$$

In this formulation the utility values are stochastic, and the utility maximizing condition can be stated as a probability of occurence, or

$$P_i = \text{Prob}[U(x_i,z) > U(x_j,z) \quad \text{for } j \neq i].$$

In a later chapter on the empirical (logit) model of discrete choice, a description will be provided of how this model is adapted for statistical estimation.

Determinants of Mortgage Instrument Demand

The utility-maximizing theory of qualitative choice can be applied to the problem of mortgage choice by viewing it either as a consumption or as an investment decision (Capozza & Gau, 1983). In the consumption framework, a borrower's choice of mortgage instruments depends on maximizing the discounted utility of consumption subject to an income or wealth constraint. This involves finding a savings path that converts the borrower's income stream into an optimal consumption pattern. Of course, savings paths differ for different mortgage instruments. When viewed from an investment perspective, the maximization problem involves choosing both a consumption/savings path and a portfolio mix containing assets of differing risk levels.

For the purposes of this study mortgage instrument demand will be viewed as a consumption problem taking place at a given point in time rather than intertemporally. These simplifying assumptions facilitate the analysis and do not detract from its generality. Given the choice between two mortgages, an FRM (f) and a VRM (v), a utility function can be specified in which there are two vectors of attributes. One contains the characteristics of a mortgage alternative (m), and one contains the characteristics of an individual borrower (z). The utility function, excluding the error term, is given by $u = U(m,x)$, and the probability of an individual choosing a VRM is

$$P_v = \text{Prob}[U(m_v,z) > U(m_f,z)]$$

In this context each of the two alternatives, f and v, has a vector of observed mortgage characteristics. These characteristics are financial, and reflect the "price components" of the mortgage such as interest rates and loan fees. Designating the expected discounted total cost of a mortgage instrument TC, when

$$TC_f < TC_v, \quad Prob_f > Prob_v.$$

This conclusion follows from conventional cost savings principles. It assumes that FRMs are either of the same risk class or less risky than VRMs. In the reverse, when

$$TC_f > TC_v$$

the probability of choosing a VRM will be greater than the probability of choosing an FRM when the borrower has made a trade-off between the increased riskiness of the variable rate loan on the one hand, and its price discount on the other.

The second vector, consisting of borrower attributes, contains observable data of a social and economic nature. In addition, this vector includes borrower expections of future economic conditions. These characteristics can be viewed as indicators of varying degrees of individual risk aversion, R. If

$$TC_f = TC_v$$

and $$R_f < R_v$$

then $$Prob_f > Prob_v.$$

Relative risk aversion may be influenced by personal

attributes such as age, as well as by net wealth, of which income and property are two components. Net benefits of a mortgage instrument, NB, - inclusive of costs and risk premiums - is a comprehensive measure of utility. When

$$NB_f - NB_v > 0, \quad Prob_f > Prob_v.$$

Elements of the Mortgage Price Vector

The single most important price component of a mortgage is the interest rate. Economic analysis gives ample reason to anticipate that interest rates will differ significantly between mortgage alternatives. As noted in the literature review, each of the five analytic approaches point to the differential being in favor of VRMs. For example, one approach suggests that even if the present value of expected interest payments, PVI, over the life of two loans f and v are such that

$$PVI_v = PVI_f,$$

the fact that VRMs allow for fluctuating payments while FRM payments are fixed leads to

$$Prob_v < Prob_f.$$

Referring to the utility-maximizing formulations of Samuelson (1969) and Hakansson (1970) in which savings and investment are viewed in discrete time frameworks under uncertainty, Capozza and Gau (1983) point out that unless variations in mortgage payments can be offset by variations in income, the consumption/savings path of the borrower will become erratic. Since, under standard assumptions

such as diminishing marginal utility of consumption and risk aversion the optimal consumption path is smooth, the VRM is an inferior instrument for borrowers. All else being equal, this implies that the size of the difference or "spread" between interest rates on the two mortgage instruments is critical in influencing choice probabilities.

Another element of mortgage price is the loan fee. These fees, while primarily compensation for lender services rendered in processing the loan application, are also used frequently by the lender as a compensation for risk-taking. From the borrower's perspective, fees are merely additional costs. Hence, as the difference between mortgage fees increases, the instrument with the cheaper of the two fees becomes relatively more attractive, ceteris paribus. This analysis holds true for other price components too, such as the duration of the mortgage and the size of the downpayment. It is also relevant for the many possible non-price concessions or penalties, such as an open line of credit or prepayment fines. The greater the difference in value of the mortgages, the more attractive is the cheaper alternative.

A final element of the mortgage price vector is economic expectations. In general, anticipated interest rates and inflation rates play a large role in most decisions to invest. This should be especially true when the investment choice involves two mortgage instruments,

one of which features an interest rate which will remain fixed for the term of the contract and the other of which features an interest rate which can be adjusted periodically by the lender depending on economic conditions. It is thus important to include economic expectations in the mortgage choice model. Borrower acceptance of VRMs should be more likely when expectations are for inflation and interest rates to fall, and less likely when the expectations are for the opposite to occur.

Elements of the Borrower Characteristics Vector

Demographic and economic data make up the vector of borrower attributes. These attributes convey information about the shape of borrower choice functions. Naturally, these choice functions are not directly observable. Some of their features, however, are implied by the general nature of discrete choice decisions, the most important of which is that they are non-linear. In decisions of this type it seems reasonable to expect that an incentive to change decisions will have a greater marginal impact on the probability of a decisionmaker choosing a given alternative when the decisionmaker is nearly indifferent between choices, than when the decisionmaker has a strong preference for one or another choice. As the marginal impacts are expected to differ depending upon the strength of the decisionmaker's choice function, the probability function implied is one which is non-linear. While the

shape of the probability function can be determined empirically by examining the error function of a given statistical model, intuition tells us that the shape of this non-linear function should be such that it is steepest near the middle and asymptotic near zero probability and one hundred percent probability.

The borrower attribute of greatest significance in mortgage decisions is likely to be income or wealth. This is because consumption/savings behavior is determined by an individual's ability to shift expenditures and diversify investments so as to maximize utility. Wealth clearly plays an important role in this activity by increasing the degree to which shifting and diversifying can occur. Having greater abilities to adjust their consumption and savings to achieve an optimal mix, higher income individuals may be viewed as more inclined to accept VRMs, despite the uncertainties associated with adjustable interest rates. In other words, higher income individuals are more able to reduce overall risk by spreading out investments among many different risk categories. Therefore, they may be more likely than others to make certain types of risky investments.

Recent tests of this principle have employed a measure of attitude toward risk which Pratt (1964) and Arrow (1965) have termed "relative risk aversion" (RRA). This empirical approach tries to determine the demand for risky assets as a function of individual wealth.

Unfortunately, despite the clarity of the theory, the overall findings of RRA studies are quite inconclusive, e.g., Siegal and Hoban (1982), and Morin and Suarez (1983). Whether risk aversion tends to decrease, increase, or remain constant as a function of income appears to depend in large part on the definitions of risk, assets, and wealth employed by the particular studies. Evidence of RRA with respect to personal variables expected to interact with risk preferences, such as age, has also been inconsistent.

Along with social factors such as a borrower's age, additional personal characteristics can be enumerated which might have an influence on mortgage choice. Factors such as race and sex, if they do have a systematic influence, can be viewed as resulting from differential risk preferences of particular groups of borrowers. It should be noted here that little in the way of theory or empirical evidence suggests that inter-group differences in risk preferences exist. To the extent that differential investment behavior is found among groups of mortgage borrowers, this behavior has been attributed to lender discrimination rather than borrower choice (King, 1980; Schafer & Ladd, 1981). As an adequate test of lender discrimation entails differentiating lending patterns with respect to individual mortgage terms, this phenomenon cannot be addressed within the context of this study. Hence, the interpretation of differential inter-group

choices will be confined to demand factors only.

Supply-Demand Equilibrium

In addition to the demand components that affect mortgage instrument selection, choice probabilities naturally incorporate supply conditions. In general, an individual lender's decision to offer a mortgage loan is a function of the price and non-price terms of a mortgage. These terms are determined in part by exogenous economic factors such as the market cost of funds and government regulations. Additionally, offer terms typically reflect loan-specific risk premiums or discounts inspired by the property for which the loan is sought, its location, age, and physical condition. Premiums or discounts may also be influenced by characteristics of the individual who is seeking the loan.

In determining the choice of mortgage instrument to provide, borrower and collateral characteristics notwithstanding, lender behavior rests on the willingness to trade price concessions for decreased interest rate exposure and other types of risk, such as default risk. Thus, interest rate spreads between the two types of mortgages, adjustments to loan fees and loan amounts, the size of the downpayment, and other mortgage features all may interact to affect lender preferences for a type of loan.

Within the context of the mortgage choice model,

market equilibrium is determined by the process of borrowers and lenders negotiating a mutually satisfactory set of mortgage terms. As this process is a competitive one, the supply of mortgage instruments can be viewed as perfectly elastic from the point of view of the individual borrower. For any mortgage instrument of a given price, an alternative instrument having a price of its own is available, where "price" includes the various sets of characteristics of the instruments. It is assumed too, that lender underwriting standards do not differ with the type of loan offered.

From the perspective of lenders the preference for a given loan offer is a function of the total costs (TC) of a mortgage instruments. Controlling for borrower-related risk, when

$$TC_f = TC_v,\ Prob_v > Prob_f.$$

This preference for VRMs stems from the more favorable asset/liability match lenders enjoy with this type of instrument (Poole, Opper, & Taylor, 1972; Gau & Goldberg, 1983). Based on the opposing preference of borrowers, it is evident that under most circumstances lenders would be willing to provide borrowers with financial incentive to accept VRMs. However, as mortgage instrument costs are a composite of several price components, conditions may arise in which concessions offered for one component may be weighed against penalties for another.

In summary, this chapter has developed a theoretical model of mortgage choice in which borrower decisions to accept a VRM rather than an FRM are viewed as discrete choice problems. Several price factors and borrower attributes are included in this model, and the general conditions under which borrowers and lenders are likely to accept VRMs are discussed. In the following chapters the theoretical model will be used to develop and specify an empirical model for estimating the probability of borrowers choosing VRMs.

CHAPTER V

EMPIRICAL MODEL OF MORTGAGE CHOICE

The Logit Model

Having described the theoretical model of mortgage choice it is now necessary to specify a statistical model that is appropriate for analyzing empirical data. Recalling that the general theoretical model of discrete choice takes the form

$$P_i = \text{Prob}\,[e(x_j,z) - e(x_i,z) < V(x_i,z) - V(x_j,z) \quad \text{for all } j \neq i]$$

McFadden (1974) and others have shown that when G is a cumulative distribution function of the difference between $e(x_i,z) - e(x_j,z)$ then the model translates to

$$G = g[V(x_i,z) - V(x_j,z)].$$

This model assumes that the error terms are not functions of the explanatory variables and are statistically independent from each other. For the model to be easily estimable and interpretable it is further assumed that V is a linear function of (x_i,z). In this way, the model can be restated as

$$V(x_i,z) = B'x_i,z$$

where B' is a vector of unknown coefficients for a typical decisionmaker (Chow, 1983).

Though there are a wide variety of functional forms

that can meet the requirements of the individual utility-maximizing model of discrete choice, this study focuses on the logistic curve. The cumulative logistic distribution gives rise to the "logit" model,

$$P_i = 1 / [1 + \exp [-[B'(x_i,z) - B'(x_j,z)]].$$

Applied to the mortgage choice problem, the observed value of P is equal to 1 if a given borrower chooses to accept a VRM (v) and 0 if an FRM (f) is chosen. The underlying probability scale for P is viewed as a theoretical index which, because of the 0, 1 observed values, cannot be measured directly without repeated trials. The index is determined by the explanatory variables where the vector x is replaced by 'm' to represent mortgage price components, and the vector z represents borrower attributes. The probability index is assumed to be a normally-distributed, continuous variable containing a random component.

Consistent with the underlying logic of discrete choice decisionmaking, the logistic function is steepest near the center and asymptotic near 0 and 1. The probability distribution for e_i and e_j which is assumed in order to generate the logit model is the Weibull distribution. The cumulative Weibull distribution for e_j takes the form

$$P_i = \text{Prob}\,[e_j < e_i] = \exp(-\underline{e}^{-(e+a_j)}) \quad \text{for all } j \neq i$$

where $\underline{e}$ is the base of the natural logarithm and $\underline{a}$ is a parameter. This distribution has the appropriate

mathematical property that the difference between two independent Weibull distributed random variables is a binary logit distribution. In other words, if the stochastic components of utility are independently Weibull, the cumulative distribution of the difference between the two gives rise to the logit model.

The logit model is equivalent in most respects to other types of discrete choice models, such as the probit model. Indeed, tests of the the logit and probit models using the same data reveal that the results of these two models are nearly identical (McFadden, 1974). Choice of the logit technique thus rests on practical considerations. It is desirable to use because, having a closed form, it is computationally more tractable than probit; it is also quicker and easier to estimate and easier to manipulate. The logit model estimation procedure is a conventional one. A log-likelihood function is formed from which a maximum likelihood estimator of the logit model coefficients is derived. To maximize the log-likelihood function the Newton-Raphson algorithim is generally used, though other algorithims are available. This iterative procedure takes as its starting point either zero or the initial estimates from a linear probability model.

Initial linear estimates are unsatisfactory except under very restrictive assumptions. As stressed earlier, a large gap exists between the discrete choice decision problem and the standard theoretical model used to

represent the economic demand process. Furthermore, the standard linear model used to statistically analyze that process is likely to perform poorly. The linear probability model suffers from three basic flaws when it is applied to discrete choices: 1) a linear model can take on values outside the range of 0 and 1; 2) the slope of a linear probability model can be biased by extreme values anchored at 0 and 1; and, 3) the estimators of a linear probability models will be inefficient due to the heteroscedastic error term (Pindyck & Rubinfeld, 1981).

Data Base and Sampling Procedure

The data used to analyze mortgage choices come from the Loan Register Report of the State of California, Department of Savings and Loan (for information regarding documentation and access to this data base see Appendix). The origins of this data base goes back to the middle seventies when it was conceived as a means of monitoring neighborhood red-lining allegations. By 1978 the Loan Register Report had evolved into a reporting program in which all state-chartered savings and loan associations were required to submit, on a month-by-month basis, a record of all the mortgage applications they received. The total number of mortgage applications received by state-chartered S&Ls made up approximately 40 percent of the mortgage activity in the state.

The monthly input to the Loan Register Report was

aggregated into quarterly files with the names, exact addresses, and dates on each application suppressed for confidentiality. Each record in the data base contained detailed mortgage application information, including the type of loan, its terms, and the characteristics of the applicant, co-applicant, and property. Due to budget cutbacks this reporting program was terminated at the end of 1981.

California was among the first states to sanction the use of alternative mortgage instruments. As far back as the sixties some banks in California had been writing mortgages with adjustable rate clauses. Thus, by 1978 variable rate mortgages of one form or another had been present in the mortgage market for several years (see Table I). As a result, the Loan Register Report contains record of both VRM borrowers and standard fixed-rate mortgage borrowers.

TABLE I

MAJOR FEATURES OF CALIFORNIA VRM[1]

1. Term of VRM may be extended to maximum of 40 years on mutual agreement between lender and borrower.

2. Rate of interest shall change not more often than once during any semiannual period, and at least six month shall elapse between any two such changes.

3. Change in interest rate shall not exceed one-fourth of one percent in any semiannual period, and shall not result in a rate more than 2.5 percentage points greater than the rate for the first loan payment.

4. Rate of interest shall not change during the first semiannual period.

5. Borrower is permitted to prepay the loan in whole or in part without prepayment charge within 90 days of notification of any increase in the rate of interest.

6. When an increase in the interest rate is required or permitted by a movement in a particular direction of a prescribed standard, an identical decrease is required in the interest rate by a movement in the opposite direction of the prescribed standard.

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[1] Based on California Civil Code and Guide to Loan Limitations for California State-Licensed Associations.

The initial sample selected for this study from the Loan Register Report for this study reflects several considerations. For practicality, the sample was limited to four quarters of the available sixteen. The specific quarters chosen were the third quarters of each year. This was done in order to compare changes over time for the four years 1978, 1979, 1980, and 1981. To control for seasonality, the use of the same quarter of each year was necessary. Further, since the reporting requirements specified that pending applications were to be included only with the June and December reports, the second and fourth quarters were eliminated from consideration. The third quarters was selected rather than the first because they were likely to contain the larger number of applications.

Borrowers, or observations, were selected on the basis of several constraints. Within each quarter only those loan applications for properties located in California that were "accepted" by lending institutions were selected. Further, only applications for loans whose amounts were greater than one-quarter but less than one hundred percent of the sale price of the property were selected; and only those loan applications for single unit, single-family, owner-occupied dwellings were selected. This process assured that each record represented a positive outcome and that both the market areas and the goods studied were relatively homogeneous. The operational

definition of "dwelling" included new and existing housing. After an initial analysis in which no major differences were found in the borrowing patterns between single unit houses and condominiums and cooperatives, these properties, be they detached or in several story buildings, were included in the definition of "dwellings". However, mobile homes were excluded as they were viewed as products unlike the ones being studied.

Another constraint imposed on the selection process relates to the S&L institutions from which the loans originated. In order to control for the possiblity of market imperfections, observations in each quarter were chosen only from those S&Ls that issued at least five loans of each type. This selection criteria assured that both types of mortgage instruments were readily available at the institution from which the loan was issued. It provides plausible grounds for assuming that borrowers were not ham pered by a lack of access to, or information about, one type of loan or the other.

After selecting observations fulfilling the above criteria and additional criteria related to specific variables (see next chapter for variable definitions) two random samples labelled 'A' and 'AA' were drawn from each quarter, save the 1981 quarter. In this year the loan market experienced a large drop in volume, hence one full sample was all that was available of the necessary size. With the exception of the 1981 data which is the full

sample, the remaining samples make up between ten and twenty-five percent of the available observations, depending upon the year (see Table II).

TABLE II

SAMPLING FRAME FOR LOAN REGISTER REPORT DATA BASE

	1978	1979	1980	1981
Full Sample				
FRM	12,359	11,319	5,259	371
VRM	3,703	5,893	2,064	152
Total	16,062	17,212	7,323	523
% Random Sample	15	10	25	100
Sample 'A'	2,409	1,714	1,810	523
Sample 'AA'	2,376	1,706	1,821	---
Final Sample 'A'[1]	2,307	1,638	1,671	498
Final Sample 'AA'	2,305	1,629	1,701	---
Pooled Models				
% Random Sub-Sample	22	30	30	100
Pooled 'A'	557	546	541	498
Pooled 'AA'	537	510	538	498

[1] These are actual sample sizes after final adjustments for inflation and variable selection criteria.

CHAPTER VI

EMPIRICAL FINDINGS - MODEL SPECIFICATION

Development of the Cross-Section Mortgage Choice Model

In the first stage of the statistical analysis individual cross-section logit models were estimated for the third quarters (the months of July, August, and September) of each year. A specification search led to equations consisting of ten independent variables. Four of these variables relate to mortgage price components while the remaining represent borrower attributes (see Table III).

TABLE III

DEFINITIONS OF VARIABLES

VRM (Dependent Variable). If mortgage choice is a VRM the value of the variable is 1. The value is 0 if mortgage choice is FRM.

Interest Rate. This continuous variable is the "stated rate" expressed in percentages.

Interest Rate Spread. Computed as the average difference between FRM and VRM interest rates per individual S&L. It is expressed in percentages.

Fee and Fee Difference. Fee is the loan fee charged for originating or processing loans. It is expressed in dollars. Fee difference is computed as the difference between estimated FRM loan fees and estimated VRM loan fees per loan per S&L (1978 dollars).

Loan Amount. All loan amounts of greater than $425,000 (1978 dollars) and less than $1,250 were eliminated.

Applicant's Monthly Income. Limited to minimum of $400 and maximum of $7,000 (1978 dollars).

Ethnicity. This variable was broken down into four dummy variables representing Spanish, Black, and Asian and White.

Age. If age was less than 18 or greater than 75, applicant was omitted; otherwise, variable represents applicant's age in years.

The specification search was part of an overall model-development strategy that is predicated on the use of two subsamples. The first sample served as a device for selecting variables and functional forms, and generating testable hypotheses. The second served as a vehicle for accepting or rejecting these hypotheses. In other words, rather than use the same data both for finding the appropriate variables and functional form of a model and for testing hypotheses on the model, this study uses one sample for experimentation and another for drawing inferences. The search over a variety of variables and functional forms is made necessarry because of the lack of theory available to guide specification of the mortgage choice model. The major advantage of this strategy is that it safeguards against purely fortuitous results. In doing so it increases the empirical model's credibility and gives heightened confidence in the model's explanatory or predictive power. Of course, it requires data sets large enough to be divided in two without losing substantial estimation precision.

Mortgage Price Components

Based on the theoretical model of mortgage choice several different mortgage price components were included in the initial empirical model for sample 'A'. Besides interest rate spreads, the level of interest rates, and fee differences, such variables as loan amounts, loan-to-value

ratios, term to maturity, downpayments and housing characteristics were also included in the preliminary models. These latter variables were tried despite the fact that either the theoretical grounds for including them were not nearly as strong or clearcut as with the former variable, or they exhibited little variability. On the whole they performed poorly, meaning that their model coefficients were not statistically significant for three of the four years and/or the signs on their coefficients switched from year to year from plus to minus. The results thus justified excluding these variables from the later models. The price component variables remaining in the model were generally significant in three of four years. They too suffer occasional inconsistencies.

Interest Rate Spread According to economic theory, the spread between VRM and FRM interest rates should be the single most important price component variable so far as mortgage choice is concerned. The problem is, there is no direct way of measuring what this spread would be for an individual borrower since the available data provides only the interest rate of the borrower's ultimate mortgage choice. What, it must be asked, might that borrower have been offered as an interest rate for the other mortgage instrument, the one not chosen?

To answer this question it was necessary to construct a variable that would approximate the interest rate of the alternative choice. This variable, "interest rate spread"

or SPREAD, is an S&L-specific variable calculated from the non-sampled data set by subtracting the average VRM interest rate offered by a given S&L from the average FRM rate offered by the same institution. Implicit in this constructed variable is the assumption that, on average, borrowers from specific S&Ls are offered the same difference in interest rates and that these differences are stable over each time period.

The SPREAD value for each S&L was attached to all borrowers from that S&L. This value is interpretable as the average difference in interest rates between the two mortgage choices offered. As indicated earlier, theory predicts that the sign of the coefficient of this variable should be positive, ceteris paribus. In the context of the discrete choice empirical model, the probability of choosing a VRM should increase as the interest rate differential between FRMs and VRMs increases. Model results bear out the theoretical expectations in three of the four years. In these three years the signs of the coefficients are both positive and statistically significant. In the fourth year the estimated coefficient has a positive sign but is not statistically significant.

Fee Difference A second variable requiring construction is the difference in S&L fees charged for the two types of mortgages. Like SPREAD, fee difference is an S&L-specific variable. Because of an absence of data, this variable is also "simulated" by calculating hypothetical

loan fees. As loan fees are dependent on the loan itself, fee differences were constructed for each individual loan by simulating the alternative loan choices. A simple linear regression model predicting loan fees as a function of loan amount was estimated for the non-sampled data set, institution by institution, for each type of mortgage instrument. Where y represents loan fees, x equals loan amounts, i represents each individual S&L, and v and f represent VRMs and FRMs respectively, these regressions took the form

$$y_{vi} = a_1 + B_1 x_{vi}$$

and

$$y_{fi} = a_2 + B_2 x_{fi}.$$

Using the two model parameters the expected loan fees for every loan offered by the individual S&Ls was computed. The difference between the expected FRM loan fee and the expected VRM loan fee makes up the constructed variable.

Initial expectations were for this variable to be positively related to the probability of choosing a VRM. As the difference between fixed and variable rate loan fees increased, i.e., VRMs became relatively cheaper, VRMs would become more attractive to borrowers. However, across all four years the estimated coefficients of this variable are highly significant but not of the same signs. In 1979 and 1981 they are positive, while in 1978 and 1980 they are negative. A possible explanation of these inconsistencies is that they reflect S&L behavior as well as borrower

behavior. A more complete treatment of this issue will be provided in a later discussions of the pooled time-series mortgage choice model.

Interest Rate Since the interest rates on mortgage instruments are their most important price feature, this variable was included in the specification of the mortgage price components to control for possible differential effects. However, as this variable does not reflect the relative price differences of the mortgage instruments, it is not expected to have a significant impact on the probability of choosing a VRM.

Mean interest rates for VRMs and FRMs in sample 'A' were comparable in three of the four years studied, differing by less than ten basis points on average. In 1981 however, mean interest rates where ninety-seven basis points lower for VRMs than for FRMs. Initial results of the model estimation exhibit inconsistency. Interest rate coefficients are positive and not statistically significant in 1978 and 1980, positive and significant in 1979, and negative and significant in 1981. Overall, little more can be said other than that the effects of interest levels on mortgage choice are highly questionable.

Loan Amount Like the interest rate variable the theoretical expectation is for loan amounts in and of themselves to have no effect on borrower mortgage choices. Interpretation of this variable from the borrower side is confounded, though, when the loan amount is viewed as a

proxy for borrower wealth. As a strong relationship exists between income and wealth, and between wealth and housing values, it is possible to view loan amount as a borrower characteristic as well as a mortgage price component. If so, it is to be expected that loan amount will be positively related to the probability of choosing a VRM. Coefficient estimates for loan amount are found to be positive and highly significant in three of the four years, and negative and not statisitically significant in the fourth year.

Borrower Characteristics

Variables representing borrower income, age, race, and sex were selected for inclusion in the mortgage choice model. Along with these attributes, additional borrower variables were experimented with in the initial specification search. For example, the race and income of the co-applicants were tentatively included in the model as well as an income/age interaction term. Based on the criteria of significance and consistency described above, the explanatory power of the model was not enhanced by the addition of these variables. Therefore, none of the additional variables were included in the later mortgage choice model.

Income As discussed earlier, a negative association is expected between risk aversion and income. As VRMs are the riskier of the two mortgage choices from the borrower's

perspective, it is hypothesized that a positive relationship exists between borrower income and the probability of choosing a VRM. Empirical results of the cross-section mortgage choice model do not strongly support this hypothesis, however.

With the exception of 1980, in which a statistically significant positive relationship is present, each of the three previous years' models result in positive but not statistically significant coefficients. A complication that may have affected the finding is the moderate colinearity found between loan amount and income in each year. Ordinarily, in non-linear statistical models estimates of the standard errors of the coefficients are not seriously influenced by correlations between independent variables unless they are very high. However, in specification tests in which loan amount was omitted from these cross-section models, income was consistently found to be statistically significant and positively related to VRM choice. These tests provide a clear indication of the interdependence of income and loan amount as proxies for net wealth. Despite this interdependence, for the integrity of the overall model loan amount was retained in the equation.

Age In order to capture potential life-cycle effects on mortgage choices, borrower age is included in the model. Income being a static variable that represents a borrower's earnings only at that point in time in which the loan is

applied for, it may be argued that it alone is not the relevant measure to examine. A more complete measure of income would account for expected lifetime earnings. In the absence of the information necessary to calculate such a variable, borrower age is entered into the model. If it is found to be statistically significant this would indicate that the stage of life of the borrower was an important determinant of relative risk aversion.

The findings of the model reveal that age is a significant variable in 1981 only. Though it is positively related to choosing a VRM in two of the years, in the remaining two the sign of the coefficient is negative. Tentatively, the hypothesis that life-cycle status is a factor in the mortgage choice decision must be rejected.

Race and Sex The dummy variable representing borrower sex is found to be not statistically significant and of inconsistent signs across the four years. Generally, the same holds true for dummy variables related to Asians, Blacks, and Spanish borrowers. In only one year is the variable representing Blacks significant - in that year, 1978, Black borrowers were found to have a greater probability of choosing VRMs than Whites. In the remaining years the coefficients are positive, but of no statistical significance. The hypotheses that borrowers of different genders and races exhibit varying degrees of relative risk aversion may tentatively be rejected (See Tables IV for model estimates).

TABLE IV

LOGIT ANALYSIS - SAMPLE 'A'

Ind. Variable[1]	Dependent variable: VRM 1978	1979	1980	1981
INTRST	0.325533	1.061095	0.094950	-0.117463
	(1.47)	(37.99)*	(1.38)	(3.33)
SPREAD	1.933160	0.413519	0.141594	5.070206
	(32.85)*	(10.11)*	(0.32)	(59.26)*
LOANAM	0.000014	0.000022	0.000013	-0.000010
	(22.50)*	(72.86)*	(27.48)*	(1.95)
FDIF	-0.004603	0.000958	-0.001259	0.001531
	(35.36)*	(5.57)*	(15.66)*	(20.44)*
INCOME	0.000018	0.000102	0.000114	-0.000142
	(0.09)	(3.46)	(4.32)*	(1.08)
AGE	0.000712	-0.000980	-0.002503	0.039272
	(0.02)	(0.03)	(0.16)	(15.83)*
SEX	-0.172220	-0.327468	-0.260422	0.515578
	(0.94)	(3.24)	(1.78)	(2.02)
SPANISH	0.357671	-0.088487	-0.041753	0.784733
	(3.17)	(0.18)	(0.02)	(2.95)
BLACK	0.678993	0.199748	0.223952	0.263422
	(8.27)*	(0.42)	(0.44)	(0.22)
ASIAN	-0.070925	-0.253227	0.057081	-0.072324
	(0.11)	(2.00)	(0.11)	(0.03)
CONST.	-5.422001	-14.25171	-3.181736	0.716648
	(4.12)	(49.83)*	(9.74)*	(0.48)
Total N	2,307	1,638	1,671	498
n of VRM	481	516	430	145
n of FRM	1,826	1,122	1,241	353
Model Chi-Square (10 d.f.)	284*	227*	181*	150*

* significance > .05

[1] Numbers in parentheses are Chi-Square ratios having the same interpretation as for OLS. Significance test is two-tailed.

Development of the Pooled Time-Series Cross-Section Model

For the second stage of analysis a pooled time-series cross-section model was specified incorporating a new vector containing economic expectations. The need for this model arises because of the mis-specification inherent in a strictly cross-sectional analysis. It is well known that expectations about the future economic climate play an important role in investment decisions. In the absence of explicit recognition of these expectations, statistical models are likely to suffer from a lack of explanatory power. In addition, mis-specified models are bound to overstate the influence of those variables that are somewhat related to economic expectations.

As with the cross-section model, a search was made of relevant variables. Economic theory and evidence clearly point to two factors of prime importance in investment decisions. These are expected interest rates and expected inflation. As the investment decision investigated here is one in which interest rate movements are particularly relevant, it is hypothesized that mortgage choice will exhibit sensitivity to these two factors. Anticipated rises in interest rates and inflation are likely to diminish the probability that a borrower will opt for a debt instrument such as a VRM which, as rates rise, will have its own interest rate adjusted upward. Variables tested included several measures of inflation and interest rates, and a measure of consumer sentiment. Ultimately,

the two variables chosen for the pooled model were those which theory predicts will perform best. In interpreting these two variables it is important to stress that one and the same value was attached to every observation of a given year. This makes them similar to dummy variables in the sense that the calculated impact of marginal changes in these variables is only meaningful from year to year; within each individual year the impact is necessarily zero.

The pooled model was estimated on a sample of observations drawn from the yearly models. Approximately one-fifth to one-third of the observations from 1978, 1979, and 1980 were included in the pooled model, along with the entire sample of observations for 1981. This stratified sampling procedure was designed to produce roughly equal representation of each year in the time-series model. This scheme was chosen, as opposed to pure random sampling, to assure that sufficient observations for 1981 would be available, and to help minimize the variances of the estimated coefficients. According to Maddala and Trost (1982), exogenous stratified sampling, in which sampling is performed with respect to explanatory variables, yields logit coefficients that are almost the same as if the sampling were random. It is only when sampling is endogenous, that is, when the sampling is based on the criterion whose determinants are being studied, (in this study the proportion of borrowers accepting one instrument or the other), that estimates will tend to be biased.

Variables present in the cross-section model after the initial specification search were included in the time-series model. Calculation of the average probability of choosing a VRM is based on the equation

$$P = 1 / [1 + \exp(-XB)]$$

where X is the vector of mean values for each independent variable and B is the vector of coefficients for the model, including the intercept term. For the pooled model of sample 'A' this equation yielded an average probability of choosing a VRM of approximately twenty-five percent.

Economic Expectations

Expected Interest Rates A variable representing expectations of future short term interest rates, TBDIF, was constructed from information gathered from the financial futures market for Treasury notes. As Treasury bills of thirteen week maturities are traded with delivery dates as far in advance as twenty months, the difference between present yields and future yields represents market expectations about the magnitude and direction of interest rates changes.

After calculating the difference between expected and present Treasury bill rates from closing prices of the day at the mid-point of the third quarter of each year, values were attached to all observations from the respective quarter. These values ranged from +2.09 percent in 1978 to -2.06 percent in 1981. To check that the values chosen in

this manner were representative of each quarter, interest rates were sampled throughout each quarter. No inconsistencies in magnitude or direction were observed for any of the four quarters. Estimation of the model yielded a statistically significant coefficient whose sign was negative.

In order to measure the impact of a small change in expected interest rates, or any of the continuous variables, on the probability of choosing a VRM, the first-order derivative of the dependent variable is calculated with respect to the independent variable. For the logit model this is implemented separately for each independent variable by evaluating the derivative with respect to the mean values of all the independent variables in the equation. The equation for the logit derivative is:

$$dY/dX_1 = B_1(\exp(-XB)) \; / \; [1 + \exp(-XB)]^2$$

where B_1 is the logit coefficient of independent variable X_1, and B and X are all the logit coefficients and the respective mean values of the independent variables.

Using this equation for estimating the impact of a marginal change in the expected interest variable, an increase of one percent (one hundred basis points) in the rate difference is calculated, on average, to decrease the probability of choosing a VRM from one year to the next by about four percent.

Expected Inflation On a regular quarterly basis the University of Michigan Survey Research Center reports

consumer expectations about a variety of general and personal economic conditions. Along with such data as expected change in income, the household survey provides useful information about household expectations of the national rate of inflation in the coming twelve months.

Using responses from the third quarter of each year, the average expected inflation rate from the Survey Research Center was attached to each observation of the pooled model for each year, respectively. The coefficient of this variable, SRIAEI, like that of the former variable, is statistically significant and reflects an inverse relatonship between expectations and the probability of choosing a VRM. A three percent decrease in the probability of choosing a VRM is estimated to be the average response to a one hundred basis points increase in the expected inflation rate.

Cross-Section Variables in the Pooled Time-Series Model

Mortgage Price Components With economic expectations controlled for, it is now necessary to reinterperet the cross-section variables. In accord with the yearly models, the fully specified model reveals a highly significant relationship between SPREAD and VRM choice, and a negative and not statistical significant relationship between VRM choice and interest rate levels. Also consistent with earlier findings, higher loan amounts are strongly related to choosing VRMs.

A seemingly surprising finding is a strong negative relationship between fee differences and the probability of choosing a VRM. According to the model, an increase in the difference between FRM and VRM loan fees of ten dollars will lead, on average, to a one-tenth of a percent decline in the probability of VRM choice. It must be remembered though, that the mortgage choice model reflects lender as well as borrower behavior. While discounted loan fees are likely to attract borrowers to VRMs, higher fees for FRMs are also an S&L response to relatively high demand for FRMs. That the statistical relationship found in this equation may be a supply side reaction is suggested by the descriptive statistics. They reveal that VRM loan fees were, on average, one hundered and sixty dollars less than FRM loan fees, despite the fact that VRM loan amounts were over fourteen thousand dollars higher, on average. What this shows is that VRM loan fees are generally more favorable than FRM loan fees. The negative coefficient may thus be capturing an S&L response to relatively high demand for FRMs at particular institutions. Alternatively, as this variable was constructed from OLS regressions, it is possible that the coefficient really is measuring part of the effect of loan amount, the key variable in estimating fee differences.

Borrower Characteristics Estimation of the pooled time-series model shows considerable agreement with the cross-section models. Variables related to race and gender

demonstrate consistency with the yearly models in that they are not significantly related to VRM choice. The same can be said for the income and age variables. In the pooled model it is found that income and age are not statistically significant. Calculation of the impacts of marginal changes on the probability of choosing a VRM indicate that a one hundred dollar change in income increases the probability of choosing a VRM by approximately one-twelfth of a percent; and a one year increase in age increases the probability by one-and-one quarter percent. The income finding supports, if weakly, the conventional hypothesis of decreasing relative risk aversion as a function of income. Similarly, the age finding lends weak support to the life-cycle hypothesis. Once again it should be noted that to the degree that loan amount is a reflection of income (r = .598), the strong positive association between it and the probability of choosing a VRM could have masked the full income effects (see Table V).

TABLE V

LOGIT ANALYSIS OF POOLED TIME-SERIES AND AVERAGE CHANGE IN THE PROBABILITY OF CHOOSING A VRM - SAMPLE 'A'

	Dependent variable: VRM[1]		
Ind. Variable	Pooled	% Chg. in Prob.(VRM) Due To Marginal Change in Ind. Var.	
INTRST	-0.035313 (0.63)	-0.66	(per increase of 100 basis points)
SPREAD	0.853975 (30.84)*	+15.97	(per increase of 100 basis points)
LOANAM	0.000015 (49.44)*	+0.29	per increase of $1000)
FDIF	-0.000551 (17.89)*	-0.10	(per increase of $10)
INCOME	0.000062 (1.44)	+0.12	(per increase of $100 per month)
AGE	0.006563 (1.79)	+1.23	(per increase of 1 year)
SEX	-0.120788 (0.55)	NA	
SPANISH	-0.144886 (0.41)	NA	
BLACK	-0.168387 (0.35)	NA	
ASIAN	-0.248402 (2.23)	NA	
SRIAEI	-0.143008 (7.30)*	-2.67	(per increase of 100 basis points)
TBDIF	-0.218295 (35.71)*	-4.08	(per increase of 100 basis points)
CONST.	-0.462472 (0.25)	NA	
Total N	2,050		
n of VRM	553		
n of FRM	1,497		
Model Chi-Square (12 d.f.)	207*		
Mean Prob. (VRM)	24.90%		

* significance > .05

[1] Numbers in parentheses are Chi-Square ratios having the same interpretation as for OLS. Significance test is two-tailed.

In summarizing the findings thus far it is important to note that the separate yearly cross-section models, though exhibiting general consistency in their results, also vary from each other in important ways. Were the analysis to conclude before estimating the time-series model, these variations would be difficult to interpret. Development of the pooled cross-section time-series model accomplishes two things. First, it helps explain why cross-sectional results may differ from year to year. Second, it is necessary for deriving stable and reliable estimates of the model's coefficients.

The key result of the pooled model is the empirical confirmation that expectations of future economic conditions are signficantly related to the probability of borrowers chooosing VRMs. In demonstrating the importance of economic expectations as determinants of mortgage choice, it becomes clear that the inconsistencies in mortgage price component variables found in the four cross-section models most probably result from unaccounted expectations. Differing expectations across each year lead to changes in the magnitude and direction of the mortgage price component variables. In short, the cross-section results must be viewed with caution. They are important in searching for the correct specifications of the mortgage choice model, leading to development of the pooled cross-section time-series model. It is this final model's results, however, which are of greatest relevance.

CHAPTER VII

EMPIRICAL FINDINGS - MODEL VALIDATION

Having used the initial yearly samples to specify the mortgage choice model, caution must be exercised in placing too much confidence in the resulting sample estimates. In order to test the robustness of these findings it is useful to estimate the model on a separate sample (Draper & Smith, 1981). If results of the second set of samples are found to match the first set consistently, the model may then be deemed generally valid, and its estimates may be evaluated with greater assurance that they are not statistical artifacts.

To test the validity of the model a second random sample of mortgage applicants, labelled 'AA', was drawn from the original pool of observations. Due to insufficient data for 1981 the full data set for this year was used in the initial estimation stage, therefore validation tests were performed only on the three prior years.

Cross-Section Mortgage Choice Model

Comparison of Mortgage Price Components Both the interest rate spread and the interest level variables are found to be fully consistent across samples. In sample

'AA' the SPREAD coefficients are positive and significant in 1978 and 1979 and positive but not statistically significant in 1980. This agrees closely with the initial sample 'A'. Likewise, the interest rate variable in sample 'AA' variable is positive in all three years and significant in 1979 only, matching sample 'A'.

Coefficients of the fee differences, FDIF, exhibit a pattern in sample 'AA' which is similar to the previous sample. In 1978 and 1980 the coefficients are statistically significant and negative, while in 1979 the FDIF coefficient is positive but lacks significance. Loan amount coefficients mirror the initial results, too. They are positive and significant for all three years as in the former sample.

Comparison of Borrower Characteristics To the extent that the regression coefficients for borrower characteristics are generally found not to be statistically significant in all three years for sample 'A' and 'AA', the findings can be viewed as very similar across samples.

Specific borrower characteristic coefficients exhibit unstable patterns. For example, the variables representing income, sex, Spanish origins, and Asian origins shift signs from sample 'A' to 'AA' in two of the three years. Variables representing age and Black origins shift signs once each. No discernible pattern emerges from these changes, lending support to the overall conclusion that borrower attributes do not significantly affect mortgage

choice in the cross section models (see Tables VI).

TABLE VI

LOGIT ANALYSIS - SAMPLE 'AA'

Ind. Variable[1]	Dependent variable: VRM 1978	1979	1980
INTRST	0.429153	1.054324	0.027436
	(2.83)	(40.12)*	(0.12)
SPREAD	2.321253	0.250388	0.127453
	(47.39)*	(4.18)*	(0.27)
LOANAM	0.000013	0.000019	0.000016
	(19.37)*	(53.60)*	(34.16)*
FDIF	-0.004662	0.000587	-0.000766
	(36.62)*	(2.34)	(5.12)*
INCOME	0.000074	-0.000006	-0.000007
	(1.68)	(0.01)	(0.02)
AGE	0.010519	0.010249	0.007631
	(3.52)	(3.40)	(1.65)
SEX	-0.246423	-0.458824	0.149456
	(2.04)	(6.96)*	(0.60)
SPANISH	0.245259	0.413392	-0.187891
	(1.47)	(4.47)*	(0.54)
BLACK	0.612554	0.201127	0.301511
	(5.82)*	(0.37)	(0.74)
ASIAN	-0.175607	0.088902	-0.035995
	(0.69)	(0.25)	(0.04)
CONST.	-6.753023	-14.10631	-3.009711
	(7.03)*	(52.18)*	(9.19)*
Total N	2,305	1,629	1,701
n of VRM	494	517	434
n of FRM	1,811	1,112	1,267
Model Chi-Square (10 d.f.)	341*	179*	146*

* significance > .05

[1] Numbers in parentheses are Chi-Square ratios having the same interpretation as for OLS. Significance test is two-tailed.

Pooled Time-Series Mortgage Choice Model

The pooled model for sample 'AA' was constructed in the same manner as the original. Random sub-samples for each year were concatenated along with the full sample for 1981. Identical values were used to represent expected differences between future and present interest rates and expected annual inflation.

Comparison of Time-Series Variables Coefficients of the two time-series variables remained consistent with the first sample. Expected interest rate differences were inversely and significantly related to the probability of choosing a VRM, and a marginal increase in this difference of one hundred basis points is estimated to decrease this probability by approximately five percent. Likewise, the expected inflation rate coefficient was statistically significant and, on average, a one hundred basis points change in this rate is calculated to decrease the probability of choosing a VRM by two percent.

Comparison of Cross-Section Variables Among the mortgage price components all four variables performed consistently between samples. The variables INTRST, SPREAD, FDIF, and LOANAM exhibit the same coefficient signs and magnitudes, as well as roughly the same marginal impacts as in sample 'A'. In sample 'AA' a one hundred basis points change in SPREAD increases the probability of choosing a VRM by twenty-one percent, as opposed to sixteen percent in the initial sample. The marginal impact of a

ten dollar change in FDIF is roughly the same between samples, as is a marginal change of one thousand dollars of loan amount.

Coefficients of borrower characteristics in the pooled model of sample 'AA' were highly consistent with those of the initial pooled sample in that all variables lacked statistical significance. Differences did appear, however, in the signs of certain variables. For income, the impact of choosing a VRM with a one hundred dollar increase changed from roughly a one-twelfth of a percent increase in the probability of choosing a VRM, to a one-hundredth of a percent decrease in the probability. For age, the marginal impacts remained about the same, again lending weak support to the life-cycle hypothesis (see Table VII).

TABLE VII

LOGIT ANALYSIS OF POOLED TIME-SERIES AND AVERAGE CHANGE IN THE PROBABILITY OF CHOOSING A VRM - SAMPLE 'AA'

	Dependent variable: VRM[1]	
Ind. Variable	Pooled	% Chg. in Prob.(VRM) Due To Marginal Change in Ind. Var.
INTRST	-0.068141 (2.26)	-1.26 (per increase of 100 basis points)
SPREAD	1.124461 (42.32)*	+20.77 (per increase of 100 basis points)
LOANAM	0.000016 (53.41)*	+0.30 (per increase of $1000)
FDIF	-0.000384 (8.22)*	-0.07 (per increase of $10)
INCOME	-0.000066 (0.01)	-0.01 (per increase of $100 per month)
AGE	0.007662 (2.26)	+1.42 (per increase of 1 year)
SEX	0.080990 (0.23)	NA
SPANISH	0.034421 (0.03)	NA
BLACK	0.112446 (0.15)	NA
ASIAN	-0.308590 (2.87)	NA
SRIAEI	-0.116901 (4.80)*	-2.16 (per increase of 100 basis points)
TBDIF	-0.271835 (53.17)*	-5.02 (per increase of 100 basis points)
CONST.	-0.436278 (0.22)	NA
Total N	2,009	
n of VRM	535	
n of FRM	1,474	
Model Chi-Square (12 d.f.)	210*	
Mean Prob. (VRM)	24.44%	

* significance > .05

[1] Numbers in parentheses are Chi-Square ratios having the same interpretation as for OLS. Significance test is two-tailed.

Comparisons of the results of the two samples reveal a high degree of agreement both for the cross-section models and the pooled time-series cross-section models. Of primary interest are the pooled models. In both samples the average probability of choosing a VRM are very similar at twenty-five percent for sample 'A' and twenty-four percent for sample 'AA'. Although the signs of the coefficients of the borrower characteristic variables differ for four of the eight variables, in no case were any of these variables found to be statistically significant. These findings confirm that borrower characteristics, with the possible exception of net wealth, do not play an important role in the decision to choose a given type of mortgage instrument.

Regarding the remaining variables, comparisons of the results for each sample show the importance of price components and economic expectations. While the level of interest rates appears to be unimportant, both the interest rate spread and expected level of interest rates are highly significant, as is the expected inflation rate. Fee differences, on average one-hundred-and-fifty dollars lower for VRMs, are also statistically significant determinants, albeit negatively related to the probability of choosing a VRM. Lastly, loan amount is a consistently important variable. Although it is likely related to net wealth, the possibility of lenders preferring to provide VRMs for higher loan amounts cannot be completely ruled out.

Statistical Reliability

Having demonstrated the robustness of the mortgage choice model for the samples analyzed, there remains to be discussed several issues regarding the reliability of the model's estimates. The first of these issues relates to the unavoidable use of the 1981 data set for both the exploratory and the validated pooled models. As this sample represented one quarter of the data set for each time-series model, the question arises as to whether the similarity of the results of these models is an artifact of sample duplication. Though some contamination is obviously present, the size of the overall samples for each model and the proportion of "new" observations tends to suggest that the general conformity of the models' estimates are a result, not of contamination, but of the overall predictive power of the specified model.

Another issue regards the confidence that can be placed in the estimates of the pooled models. In order for these estimates to be reliable, the assumptions for the model require that the structure of the cross-section models be similar from one year to next. An examination of the signs, magnitudes, and levels of significance of the variables from year to year reveal that for sample 'A' the structure of the cross-section models for years 1978, 1979, and 1980 appear quite similar. However, there is somewhat of a discrepancy between the coefficient estimates for these years and 1981. In particular, the coefficients for

the intercept term and the variables representing interest rate spread and loan amount exhibit large differences either in magnitude or direction. Examination of the second sample 'AA' finds similar discrepencies.

To check for structural changes from 1978-1980 to 1981 the pooled time-series cross-section models were run again for both samples with the addition of a dummy variable to represent 1981. The estimation yielded results indicating that no abrupt change had occurred in 1981. Not only did the coefficient for the dummy variable fail to achieve statistical significance in either sample, but the inclusion of this variable provided no additional explanatory power to the models. The latter finding was determined by the Chi-Square test of statistical significance of the ratio of the difference between the restricted and unrestricted models' "-2 log likelihood" statistics. The results for both samples proved not to be statistically significant at the five percent level. This test provides strong evidence that the variations in cross-section results are explained by variations in economic expectations rather than structural shifts in the demand for mortgage instruments.

A final issue related to the statistical reliability of the mortgage choice model regards one of the unique features of the logit regression model, the axiom known as the "independence of irrelevant alternatives" (IIA). McFadden (1974) and others have shown that one of the

assumptions which underlie the statistical properties of the logit model is that no loss of generality is entailed when excluding an alternative from the choice model. In other words, the relative probabilities of the choices analyzed do not depend on the presence of another existing alternative. For example, if the choices specified in a logit model of transportation choice are mass transit versus automobile, an excluded alternative such as "walking" will not distort the estimation of the relative probability of choosing mass transit versus automobile. The logic behind the IIA property is that alternatives which are distinctly different from the ones in question, though they are a part of the overall choice set, do not influence the choice between the two alternatives that are observed.

Discussion of the IIA assumption is especially relevant when analyzing the mortgage choice model findings. To the extent that alternative mortgage instruments excluded from the study can be viewed as distinctly different from FRMs and VRMs, the model estimates are statistically independent of those alternatives and are reliable probabilities. Omission of other forms of financing, such as seller-financed or "creative" mortgages and FHA financing, may be treated likewise. Though these types of mortgages are sometimes substitutes for FRMs and VRMs, they are no better substitutes for one type of mortgage than another. Thus, they cannot be viewed as

influencing the choice between the two.

The major shortcoming of the IIA axiom is in situations where alternatives which are close substitutes for each other are incorporated into the same model. If, for example, two alternative mortgage instruments whose features differ only slightly are included in a model alongside the conventional FRM, estimates of the probability of choosing an FRM will be driven downward. In essence, if the two alternative instruments are nearly identical, the effect of treating them as distinct choices is equivalent to double counting. Though in reality their combined probability should be equal to the probability of choosing just one of them, the logit model treats the two choices as distinct. It thus assigns the two a larger share of the probability than is warranted (McFadden, 1974; Maddala, 1983).

In this study, the IIA shortcoming does not present a problem. There was one year, 1981, in which, unlike the previous years, FRMs and VRMs were not the only major mortgage choices. In that year another type of mortgage instrument, the flexible payment mortgage (FLEX), rivaled the VRM in popularity. This instrument is like the VRM in some ways, yet in addition to interest rate changes, the monthly payment on the loan principal may be adjusted, too. This difference is critical, because it means that unlike VRMs, FLEX payment schedule adjustments can result in negative amortization. As such, FLEXs cannot be viewed as

very close substitutes for VRMs. For practical reasons, and because their exclusion posed no threat to the reliability of this study, analysis of FLEX choice was not pursued.

In summary, tests of the validity of the mortgage choice model based on a second set of Loan Register Report samples reveal that the models' estimates are highly consistent both for the yearly samples and for the pooled time-series cross-section samples. The findings demonstrate that the results are unlikely to be statistical artifacts arising from the initial specification search. In the pooled model which is of primary interest, borrower characteristics were found to be of little importance in the decision to accept VRMs. It is argued, however, that borrower wealth, to the extent that it is reflected in loan amounts,is an important determinant of VRM acceptance. Lastly, mortgage price components and economic expectations were found to be highly related to mortgage choice. These results are unlikely to have been influenced by the inclusion of the 1981 observations in both pooled samples, nor by the exclusion of other types of mortgage instruments from the choice model. Further, no support is found for the possibility that a structural change in demand took place between 1978-1980 and 1981.

CHAPTER VIII

IMPLICATIONS FOR THE MORTGAGE MARKET

This study uses mortgage application information to examine the economic determinants of borrower mortgage choice decisions. The findings of this study support two major hypotheses that flow directly from the economic literature. These hypotheses are: 1) relative mortgage prices have a significant impact on borrower decisions; and, 2) economic expectations play a large role in choosing mortgage instruments.

These findings lead to a better understanding of the factors influencing borrowers to select fixed or variable rate mortgages. Thus, they have broad implications for the mortgage market. They serve to provide insight into the influence of economic conditions on borrower demand for VRMs, as well as serving as a means of evaluating the impact of regulatory changes on borrower demand. Finally, the findings help put into perspective a critical issue about which little is yet known, VRM default risk.

Before engaging these topics, a discussion of the limitations of the generalizability of this study to the mortgage market is in order. As such, the representativeness of this study's sample is considered from several different perspectives.

Generalizability of the Study

The subject of this research is borrowers' decisions to accept FRMs or VRMs for the purpose of buying single-family owner-occupied homes. To focus in on this subject and concentrate on "average" borrowers, the sampling excluded government-sponsored FHA and VA mortgage loan borrowers. The sample frame also limited the observations studied to borrowers whose income and home prices fell within a broad range that eliminated very low and very high levels of wealth. In addition, exceptionally young or old borrowers were excluded from the study, as were the few borrowers whose reported racial backgrounds were other than the four main groups of White, Asian, Spanish, and Black. These constraints, while tightening the regression model estimates for the selected observations and helping to avoid the problems posed by statistical outliers, limit the extent to which the findings of this study can be carried over to all members of the borrower population.

Further limitations on the generalizability of this study's findings may be thought to arise from the source of the data itself, i.e., state-chartered S&Ls, in the form of self-selection bias. Self-selection, meaning that the population studied systematically differs from the general population of borrowers, can cast doubts about the applicability of the model estimates to those borrowers who did not patronize these lending institutions. As indicated

earlier, the Loan Register Report is a data base which only state-regulated savings and loan associations in California were required to maintain. As such, all lending transactions by federally-chartered institutions and other commercial and private lenders are unavailable for study. Also, seller or "creative" financing transaction data are not contained in the Loan Register Report.

Though self-selection bias usually cannot be ruled out of most studies, the issue is really one of how serious its effects may be on the study's results. In the case of this study, it seems reasonable to expect that its effects are slight. This is because state-chartered S&Ls handled between one-third and one-half of all residential mortgage transactions conducted by lending institutions in California. This proportion is sufficiently large to assure that S&L borrowers are representative of the overall borrower population in California.

Mortgage Pricing and Interest Rate Expectations

The major component of mortgage prices examined in this study is interest rate spreads. As indicated earlier, estimates derived from the pooled models reveal that a one hundred basis point increase in this variable leads to an increase in the probability of choosing a VRM from between sixteen and twenty-one percent, depending on the sample.

As the mortgage choice model demonstrates, the impacts of mortgage price components must be interpreted

with respect to expectations of future economic conditions. This suggests that estimates of the impacts of given levels of independent variables are sensitive to changes in economic expectations. It also suggests that the average probability of choosing a VRM is affected by different interest rate expectations. In order to test these hypotheses, the impacts of marginal changes in interest rate spreads on the probability of borrowers choosing VRMs, and the effects of changes in the mean probability, were estimated at expectation levels other than the mean expectation. In the original calculations, the mean difference between future and present interest rates was nine-thousandths (.009) of a percent, or nine-tenths of a basis point, reflecting the average of both positive and negative expectations.

First-order derivatives (dY/dX) were recalculated for SPREAD at the minimum and maximum values of the expected interest rate variable (TBDIF), keeping all other variables at their means as in the former calculations. When TBDIF was at its maximum, i.e., interest rates were expected to rise in the future by +2.09 percent, the following effects are noted.

In sample 'A' the impact of a one hundred basis points increase in SPREAD changes from an increased probability of sixteen percent to an increased probability of only twelve percent. In sample 'AA', the impact of a marginal change in SPREAD declines from twenty-one percent

to fifteen percent. In other words, expectations of higher interest rates decrease the effects of a marginal increase in the interest rate spread by approximately one-fourth. Hence, a larger inducement by way of interest rate differentials would be required to achieve a given probability of borrower acceptance when expectations of higher interest rates are present. The effect of higher interest rate expectations is reflected also in the mean probability of choosing a VRM. At the higher expectation level the overall probability of choosing a VRM shrinks from twenty-five percent to seventeen percent in sample 'A', and from twenty-four percent to sixteen percent in sample 'AA'.

Looking at the effects when expectations are for interest rates to decline, that is, when TBDIF is at its minimum of -2.06 percent, the reverse is found. Now, a one hundred basis points increase in SPREAD increases the probability of choosing a VRM from sixteen percent to nineteen percent in sample 'A', and from twenty-one percent to twenty-six percent in sample 'AA'. Average probabilities of choosing a VRM rise from twenty-five percent to thirty-four percent in the former sample, and from twenty-four percent to thirty-six percent in the latter (see Tables VIII).

TABLE VIII

EFFECTS OF INTEREST RATE EXPECTATION LEVELS
ON THE PROBABILITY OF CHOOSING A VRM

Percent Change in Prob.(VRM) Due To Marginal Changes -
Calculated at Three Levels of Interest Rate Expectations[1]

	Mean (+0.009%)	High (+2.09%)	Low (-2.06%)
SPREAD[2]			
Sample 'A'	+15.97	+12.28	+19.23
Sample 'AA'	+20.77	+14.82	+26.03
Mean Prob. (VRM)			
Sample 'A'	24.90	17.39	32.24
Sample 'AA'	24.44	15.62	36.38

[1] Levels of interest rate expectations represent the mean, minimum, and maximum values of the variable TBDIF. It is computed as future interest rates for 91-day Treasury bills minus present interest rates, for each of the four periods studied.

[2] The variable SPREAD is evaluated at its mean along with the means of all the remaining independent variables. The same holds true for the calculation of the average probability of choosing a VRM.

These estimates support the theoretical model of mortgage choice in that they demonstrate that interest rate expectations have a large impact on mortgage pricing decisions. Expectations of higher interest rates lower the probability of borrowers choosing VRMs, and lower the impact of a marginal change in interest rate spreads. Parallel but opposite conclusions follow from lowered interest rate expectations.

These findings are very meaningful for the mortgage market, particularly for S&Ls wishing to maintain a given proportion of VRMs in their portfolios. They indicate that the pricing of VRMs to achieve a given level of acceptance must take into account the magnitude of expectations of future interest rates. With regard to the overall probability of borrowers choosing VRMs and the impact of interest rate spreads, this exercise demonstrates that two hundred basis point changes in interest rate expectations in either direction can lead to relatively large changes in VRM acceptance.

Importance of the Regulatory Context

This study provides empirical evidence in support of the many theoretical analyses which suggest that the relative difference in the initial interest rates of mortgage instruments offered to borrowers is a critical factor in borrowers' decisions to accept VRMs. However, in the theoretical studies, in order to focus on interest rate

differentials, all other price and non-price components of mortgage instruments are ignored. This study differs in that the findings are embedded in the context of several pricing features. Equally important, the findings are set in a specific regulatory context in which non-price mortgage features are mandated by government. These non-price features include various restrictions on VRM interest rate adjustment, and tax regulations.

As may be recalled, the Civil Code of the State of California limited the magnitude and timing of adjustments to VRM interest rates. Among other things it also placed a ceiling of two-hundred-and-fifty basis points on the absolute amount the interest rate could rise for any given loan. In addition, prepayment penalties to borrowers were disallowed provided certain conditions were met. Clearly, these elements may be expected to have a significant impact on VRM acceptance.

While this study cannot address the question of how much the various aspects of the regulatory framework contributed to the observed effects of relative prices, it contains important implications regarding this issue. Specifically, the findings suggest that VRM regulations that are less favorable to borrowers will tend to make them require more favorable pricing terms to accept VRMs. Thus, higher ceilings and shorter adjustment periods may be expected to cause interest rate spreads and other forms of pricing discounts to grow.

Another important way in which the regulatory environment may affect the relative price of mortgage instruments and borrower demand is through tax laws. For example, tax reform which affects borrower's tax liabilities may be expected to have an impact on the level of borrower acceptance of VRMs. If initial and average lifetime interest rates on VRMs are lower than FRMs, then the higher the marginal tax rates of borrowers, the greater the interest payment deductability enjoyed by FRM borrowers. Under these circumstances, VRMs borrowers require greater price discounts to offset the fact that they must claim a smaller tax shelter. Lowering marginal tax rates reduces the level of tax benefits borrowers receive via interest rate payment deductability, and thus reduces the edge that FRMs enjoy. Discounts for VRMs may then be expected to decline as borrowers find less tax advantage in the higher interest rates of FRMs.

These examples illustrate two important ways in which the regulatory environment can affect the demand for VRMs and their prices relative to FRMs. They highlight the importance of the legal and policy contexts in which VRMs are offered. As the regulatory framework for mortgages can vary from year to year and from jurisdiction to jurisdiction, this aspect of mortgage instrument pricing is an important one for policymakers and lenders to consider.

VRM Default Risk

A final issue related to the determinants of residential mortgage choice is the degree to which VRM borrowers are more likely to default on their loans than FRM borrowers. The magnitude of this risk is critical both to borrower and lender acceptance of VRMs.

Like interest rate risk which lenders seek protection against by offering VRMs, the risks of delinquency, default, and foreclosure constitute a major class of investment risks. In a study of potential alternative mortgage instrument default and foreclosure rates (Swan, 1977) the problems involved in weighing default risks and balancing them against interest rate risk is articulated:

> The abundance of possible factors that might affect delinquency and foreclosure experience make (sic) it difficult to neatly summarize the impact of alternative mortgage instruments on mortgage default. Some factors work one way while others work in the opposite direction....If thrifts want to reduce their exposure to one form of risk (e.g., interest rates), they may have to increase their exposure to other forms of risk (e.g., defaults) and accept reduced profits....To seek to protect earnings and eliminate all risks is asking too much. (Chapter IX, pp. 28-29)

On the other hand, Swan points out that the mere existence of additional choices in the market would, by itself, create benefits. He also speculates that self-selection of borrowers and lenders may tend to sort loans out in such a way that default risk would be minimized.

Defaults on mortgages are generally viewed as related to three major factors. These are: 1) loan

characteristics, such as the term of the mortgage and the equity-to-value ratio; 2) household characteristics, such as income, number of dependents, and marital status; and 3) property characteristics, such as the condition of the house and the type of neigborhood. As yet, little is known about the way in which these factors affect default risks for VRMs. As this issue is critical to VRM acceptance, it is instructive to survey the accumulated research on this subject.

In an early simulation study of credit risk, state-level aggregation of mortgage payment-to-income ratios were computed for a nationwide loan program sponsored by the Farm Credit System (Stansell & Millar, 1976). Using borrower income projections and the actual interest rates on Federal Land Bank VRMs for rural homes between 1972 and 1974, this study found that the adjusted mortgage payment-to-net-income ratio did not constitute an undue burden on households. That VRMs had a benign effect on projected defaults was also found in a study using loan-to-value ratios as its major measure of risk (Follain & Struyk, 1977).

Similar results to those obtained in the latter two studies were found in a more extensive simulation (Vandell, 1978) in which the default model contained variables representing payment burden over time, equity accumulation over time, and increased initial borrower effort to meet mortgage payments. VRMs and FRMs performed similarly under

most conditions. Vandell's default model was replicated in two further simulations (Crawford, 1981; Crawford & Harper, 1982). Their conclusions support those of the original study.

Finally, the most recent default-related study (Webb, 1982) is a wide departure from the previous ones. Using actual survey data on borrower characteristics over an eight year period, 1968-75, this study seeks to determine potential mortgage delinquencies based upon payment-to-income ratios and differences in mortgage instrument terms. Though like the former studies this one includes income among its explanatory variables, it ignores equity as a factor, entering instead into the analysis specific borrower variables such as household income sources, income variability and trend, and sex, age, and race of household head. The general finding of this study was that all varieties of alternative mortgage instruments studied had greater risks of mortgage delinquencies associated with them than did the FRMs. Specific findings included differential risk and differential severity of risk in particular circumstances for occupational groups, racial groups, age groups, and households according to sources of income.

It is clear from these studies that there is much that remains to be learned about the differential default risks associated with VRMs. To date, few if any studies have used actual borrower or S&L data to empirically

estimate the determinants of default.

Despite the seemingly contradictory findings of the simulation studies, there are reasons to believe that in general, default risk may be no different for VRMs than for FRMs. Studies dealing with alternative mortgage instrument acceptance by private mortgage insurance companies (Swan, 1977) and the secondary mortgage market (Plant & Jannuzzi, 1977) reveal that the financial institutions that are involved in mortgage negotiations other than primary lenders tend to view the instruments similarly to the way they view FRMs. Particularly where they carry restrictions moderating borrower risks, such as limits on payment increases required by California regulations, their treatment by private mortgage insurance companies was unexceptional. In general, it was found that secondary lenders employed the same underwriting criteria of "quality" for all mortgages traded, but in addition included in their criteria future borrower income expectations along with present borrower income.

Although the present study does not address the issue of default, two implications regarding default risk follow from the findings. First, to the extent that the probability of choosing a VRM has been found to be influenced by expectations of future economic conditions, and that these expectations in turn influence the interest rate spreads on VRMs, it is evident that borrowers are sensitive to the risks associated with VRMs and attempt to

offset them accordingly with reduced interest rates. This suggests that if borrowers are correct in their expectations, default risk may be no different for VRM borrowers than for FRM borrowers. On the hand, if borrower expectations are in error, default risk may be heightened. Second, to the degree that borrower wealth is an important factor in default risk, VRM borrowers may be at no greater risk of default than FRM borrowers. This is because, as may be recalled, the findings indicate that the probability of choosing a VRM increases as borrower wealth increases. As wealthy borrowers have the financial wherewithall to face increased mortgage payment burdens, default risk may not be a serious concern. To some degree this confirms the notion that borrower self-selection mitigates increased default risk.

In summary, this chapter has focused on linking the findings of this study to general mortgage market issues. The study samples' limitations being noted, quantitative estimates of the relationships between interest rate expectations, interest rate spreads, and the probabilities of choosing a VRM were reported. Following this, the impact of the regulatory environment on VRM acceptance was discussed. Lastly, a review of the research related to VRM default risk was offered, along with a discussion of the how the implications of this study's findings relate to differential default risk for VRM borrowers.

CHAPTER IX

SUMMARY AND CONCLUSION

To study the determinants of borrower demand for VRMs this research uses a data base consisting of loan application information obtained from California S&L associations between the years 1978 and 1981. After selecting observations based on a number of criteria intended to make the study representative of a large segment of the borrower population, a discrete choice (logit) model was specified in order to estimate the probability of borrowers choosing VRMs as opposed to FRMs. This mortgage choice model was made up of mortgage price components, borrower characteristics, and economic expectations.

Validating the mortgage choice model entailed comparing the statistical estimates of both a yearly cross-section model and pooled time-series cross-section model for two sets of stratified samples. The models' estimates were found to be highly consistent across samples. Within the regulatory context of the California mortgage market, the pooled time-series model revealed that borrower characteristics other than wealth are not important determinants of mortgage choice, whereas mortgage price components and economic expectations are important

determinants.

One of the principle findings of this study is that borrower willingness to accept VRMs is directly related to the margin of difference between FRM interest rates and VRM interest rates, and not at all related to the absolute level of interest rates. Evidence supporting the interest margin finding is consistent both in the cross-section and the pooled time-series models, and across the two sets of samples. Based on the fully-specified time-series model, a one hundred basis points increase in FRM rates relative to VRM rates increases the probability of choosing VRMs by between approximately sixteen and twenty-one percent.

The distinction made in this study between relative interest rates and absolute interest rate levels is an important one. The lack of statistically significant findings for the variable representing interest rate levels in the pooled time-series model makes it is evident that interest rate levels do not affect strongly the probabability of borrowers choosing VRMs. Support is thus lacking for the position taken by many mortgage finance analysts that, by carrying lower interest costs at the start of the contract term, VRMs make housing more "affordable" during periods of high interest rates. Alternatively, though the findings of this study indicate that VRMs do not have a direct affect on affordability, the presence of VRMs in the mortgage market does have an indirect effect. This is because VRMs provide borrowers

with another means of adjusting their investment portfolios to changing economic conditions.

Another finding supported by the statistical evidence is that economic expectations of rising inflation and rising interest rates tend to draw borrowers away from the VRMs towards the conventional FRM instruments. As indicated by the time-series model, marginal changes in each of these expectations are likely to decrease the probability of choosing VRMs from one year to the next by roughly two to five percent. These results find agreement with the Albaum and Kaufman survey results for California borrowers (1977), in which they found that the higher interest rate were expected to be, the more negative the attitude towards VRMs.

Of the several borrower characteristics included in these models, two major conclusions emerge. First, the data consistently reveals that borrower characteristics related to race and gender do not systematically affect borrower probabilities of selecting mortgage instruments. This lends additional credence to the notion that borrowers of various social groups do not exhibit differential risk aversion. In general, it supports the economic paradigm that individuals make consumption and investment decisions based on price signals, irrespective of their social groupings. These findings also tend to agree with the findings of the Albaum and Kaufman survey in which no differences were found between VRM and FRM borrowers with

respect to sex and ethnic groups.

Conversely, the findings lend partial support for the notion that wealth is an important determinants of mortgage choice. Though the cross-section models show little or no effect for income, when considering the highly significant effects of the mortgage loan amount for each set of samples and models, the evidence tilts in the direction of an increasing probability of choosing VRMs as wealth increase. As loan amount is a broader indicator of wealth, it is argued here that this is a more relevant measure than is income. These findings are in direct contrast to those of Albaum and Kaufman, who found that it was borrowers with relatively less income and net wealth who tended to have VRMs.

Interpretation of the findings for loan amount necessarily brings up the issue of supply-side influences on the mortgage choice probabilities. While it is argued that the loan amount findings are indicative of borrower wealth status - and thus consistent with the hypothesis of decreasing borrower risk aversion as wealth rises - the alternative hypothesis that loan amount is a manifestation of lender preferences cannot be ruled out.

Supply conditions also cannot be ruled out as an explanation of the effects of differences between loan fees levied on FRMs and VRMs. Though the cross-section estimates vary, the pooled time-series estimates consistently indicate a significantly negative relationship

between fee differences and the probability of choosing VRMs. This finding may be a result of differential risk premiums for FRMs. Alternatively, it could be a statistical artifact resulting from construction of the variable.

In addition to these findings the sensitivity of borrower mortgage choice was estimated for given levels of interest rate expectations. It was found that expectations of increasing interest rates decrease the probability of choosing a VRM from approximately twenty-five percent to approximately sixteen percent. Conversely, expectations of decreasing interest rates increase the probability of choosing a VRM to approximately thirty-four percent. Similarly, expectations of increasing interest rates affect the influence of interest rate spreads on the probability of choosing a VRM. While a marginal change of one hundred basis points increases the probability of choosing a VRM by approximately eighteen percent when calculated at the mean level of interest rate expectations, an increase in these expectations lowers the interest rate spread impact to approximately fourteen percent. On the other hand, decreased expectations increase the impact of a marginal change in interest rate spreads to approximately twenty-two percent.

Encouraging homeownership has been one of the major goals of developing and marketing alternative mortgage

loans. In inflationary periods such as this country has experienced over the past fifteen years, seemingly prohibitive nominal interest rates raise the spectre of an "affordability" crisis in housing. VRMs, the instrument examined in this research, and other types of alternative mortgage instruments as well, have thus been viewed by regulators and lending institutions as a means of easing the mortgage payment burdens of borrowers. In the case of VRMs, the main advantage to borrowers is in allowing them to enjoy an initially lower interest rate on their new mortgages than a conventional FRM offers.

From the perspective of the S&L industry, VRMs have been viewed as a necessary tool for portfolio restructuring. Seeking relief from their position in the 1970's of being heavily exposed to interest rate risk, S&Ls have sought viable ways to insulate themselves from interest rate fluctations while still providing long-term mortgage loans. VRMs, which shift much of the interest rate risk burden to borrowers, are one such solution.

In the course of establishing a large and long-lasting presence in the mortgage market VRMs had first to gain the approval of the many government agencies which regulate lending institutions. These agencies are charged with protecting the public from undue financial costs and dangers. Until recently, the actions of these public institutions and agencies indicated that they believed VRMs to be unacceptable to the housing finance market.

Reform has come about, however. In 1982 Congress acted to declare VRMs and many other types of mortgage instruments expedient and necessary for the mortgage market. Additionally, many of the broader regulations not directly meant to affect the housing market, yet having a large impact on it, such as interest rate ceilings, are being rapidly eliminated. What remains to be seen is how individual states, which are free to impose their own unique regulations on mortgage lending, are responding. Thus far it appears that they are responding with guarded approval.

Having overcome the major hurdles of government regulations, VRMs must continue to pass the more critical test of the housing market itself. Ultimately, the fate of all alternative mortgage instruments depends on whether or not borrowers and lenders believe that it is in their own best interests to use them. What is required then, is for borrowers and lenders to agree on mutually satisfactory mortgage terms. By doing so the interests of both parties, and the mortgage market in general, will be served. The findings of this study provide evidence in support of the fact that this process is indeed taking place. It further identifies those factors which, from the borrower perspective, are most important to the mortgage choice decision.

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APPENDIX

Loan Register Report data used for this study are available at the Center for Urban Studies, Portland State University. Along with storage tapes of complete third quarter data for the years 1978 through 1981, the Center maintains a file containing code books and documentation for the Loan Register Report. For more complete information or further data base rental requests, the Los Angeles branch of the California Department of Savings and Loan can be contacted.

The following tables contain statistics generated for all the estimated cross-section and pooled time-series cross-section models discussed in this study. Data analysis for this study was performed using Statistical Analysis Systems (SAS).

Logistic Regression - 1978
Sample 'A'

DEPENDENT VARIABLE: VRM

2307 OBSERVATIONS
1826 VRM = 0
481 VRM = 1
0 OBSERVATIONS DELETED DUE TO MISSING VALUES

VARIABLE	MEAN	MINIMUM	MAXIMUM	RANGE
INTRST	9.89632	7.5	10.75	3.25
SPREAD	-0.0385867	-0.3977	0.6634	1.0611
LOANAM	64083.1	6200	250000	243800
FDIF	17.6502	-1038.71	710.08	1748.79
INCOME	2219.81	400	7000	6600
AGE	37.2579	20	75	55
SEX	0.805132	0	1	1
SPANISH	0.0866927	0	1	1
BLACK	0.0446467	0	1	1*
ASIAN	0.0849588	0	1	1

* WARNING: VARIABLE HAS LIMITED DISPERSION.
IT MAY BE A BAD CANDIDATE FOR THE MODEL.

-2 LOG LIKELIHOOD FOR MODEL CONTAINING INTERCEPT ONLY= 2362.17

MODEL CHI-SQUARE= 295.68 WITH 10 D.F. (SCORE STAT.) P=0.0 .
CONVERGENCE OBTAINED IN 6 ITERATIONS. R= 0.334.
MAX ABSOLUTE DERIVATIVE=0.63200-06. -2 LOG L= 2078.03.
MODEL CHI-SQUARE= 284.14 WITH 10 D.F. (-2 LOG L.R.) P=0.0 .

VARIABLE	BETA	STD. ERROR	CHI-SQUARE	P	R
INTERCEPT	-5.42200114	2.67092576	4.12	0.0424	
INTRST	0.32553288	0.26822450	1.47	0.2249	0.000
SPREAD	1.94316020	0.33730106	32.85	0.0000	0.114
LOANAM	0.00001375	0.00000290	22.50	0.0000	0.093
FDIF	-0.00460789	0.00077413	35.36	0.0000	-0.119
INCOME	0.00001810	0.00006047	0.09	0.7647	0.000
AGE	0.00071207	0.00567430	0.02	0.9001	0.000
SEX	-0.17222061	0.17726164	0.94	0.3313	0.000
SPANISH	0.35762055	0.20079465	3.17	0.0749	0.022
BLACK	0.62859271	0.23614181	8.27	0.0040	0.052
ASIAN	0.07012499	0.21102666	0.11	0.7369	0.000

FRACTION OF CONCORDANT PAIRS OF PREDICTED PROBABILITIES AND RESPONSES = 0.707
SOMERS' CORRELATION BETWEEN PREDICTED PROBABILITY AND RESPONSE = 0.437

CORRELATION COEFFICIENTS / PROB > |R| UNDER HO:RHO=0 / N = 2307

	VRM	INTRST	SPREAD	LOANAM	INCOME	AGE	SEX	FDIF	SPANISH	BLACK	ASIAN
VRM	1.00000	0.02281	0.07760	0.31803	0.20367	0.01751	0.01088	-0.28549	-0.01403	0.04921	-0.01479
	0.0000	0.2734	0.0002	0.0001	0.0001	0.4005	0.6014	0.0001	0.5007	0.0181	0.4776
INTRST	0.02281	1.00000	-0.00055	-0.01612	0.00396	-0.00993	-0.01656	0.01823	0.00278	0.05393	-0.04097
	0.2734	0.0000	0.9789	0.4389	0.8494	0.6335	0.4266	0.3815	0.8938	0.0096	0.0491
SPREAD	0.07760	-0.00055	1.00000	-0.02983	-0.03239	-0.00362	-0.04554	0.10595	0.04615	-0.00008	-0.01663
	0.0002	0.9789	0.0000	0.1520	0.1199	0.8621	0.0287	0.0001	0.0267	0.9970	0.4247
LOANAM	0.31803	-0.01612	-0.02983	1.00000	0.63246	0.04032	0.11504	-0.65005	-0.16288	-0.03774	0.03157
	0.0001	0.4389	0.1520	0.0000	0.0001	0.0528	0.0001	0.0001	0.0001	0.0699	0.1296
INCOME	0.20367	0.00396	-0.03239	0.63246	1.00000	0.17828	0.11566	-0.41645	-0.16906	-0.03738	-0.06036
	0.0001	0.8494	0.1199	0.0001	0.0000	0.0001	0.0001	0.0001	0.0001	0.0726	0.0037
AGE	0.01751	-0.00993	-0.00362	0.04032	0.17828	1.00000	-0.07911	-0.01475	-0.06822	0.01124	-0.04752
	0.4005	0.6335	0.8621	0.0528	0.0001	0.0000	0.0001	0.4787	0.0010	0.5896	0.0225
SEX	0.01088	-0.01656	-0.04554	0.11504	0.11566	-0.07911	1.00000	-0.09889	0.05301	-0.07351	0.04151
	0.6014	0.4266	0.0287	0.0001	0.0001	0.0001	0.0000	0.0001	0.0109	0.0004	0.0462
FDIF	-0.28549	0.01823	0.10595	-0.65005	-0.41645	-0.01475	-0.09889	1.00000	0.09532	0.01503	0.01013
	0.0001	0.3815	0.0001	0.0001	0.0001	0.4787	0.0001	0.0000	0.0001	0.4705	0.6267
SPANISH	-0.01403	0.00278	0.04615	-0.16288	-0.16906	-0.06822	0.05301	0.09532	1.00000	-0.06660	-0.09388
	0.5007	0.8938	0.0267	0.0001	0.0001	0.0010	0.0109	0.0001	0.0000	0.0014	0.0001
BLACK	0.04921	0.05393	-0.00008	-0.03774	-0.03738	0.01124	-0.07351	0.01503	-0.06660	1.00000	-0.06587
	0.0181	0.0096	0.9970	0.0699	0.0726	0.5896	0.0004	0.4705	0.0014	0.0000	0.0015
ASIAN	-0.01479	-0.04097	-0.01663	0.03157	-0.06036	-0.04752	0.04151	0.01013	-0.09388	-0.06587	1.00000
	0.4776	0.0491	0.4247	0.1296	0.0037	0.0225	0.0462	0.6267	0.0001	0.0015	0.0000

Correlation Matrix - 1978
Sample 'A'

Descriptive Statistics - 1978 Sample 'A'

VARIABLE	N	MEAN	STANDARD DEVIATION	MINIMUM VALUE	MAXIMUM VALUE	STD ERROR OF MEAN	SUM	VARIANCE	C.V.
VRM=0									
INTRST	1826	9.8936522	0.2368206	7.500000	10.75000	0.00554203	18065.81	0.06	2.394
SPREAD	1826	-0.0445173	0.1632982	-0.397700	0.66340	0.00382148	-81.29	0.03	-366.820
LOANAM	1826	59204.0788609	21539.1988788	13800.000000	182000.00000	504.05643055	108106648.00	463937088.34	36.381
INCOME	1826	2099.3795181	1023.0402035	400.000000	6827.00000	23.94100153	3833467.00	1046611.26	48.731
AGE	1826	37.1648412	10.4985161	20.000000	75.00000	0.24568437	67863.00	110.22	28.249
SEX	1826	0.8833516	0.3210888	0.000000	1.00000	0.00751406	1613.00	0.10	36.349
FDIF	1826	37.2036491	113.7927007	-650.910000	710.08000	2.66295617	67933.86	12948.78	305.864
SPANISH	1826	0.0887185	0.2844149	0.000000	1.00000	0.00665583	162.00	0.08	320.581
BLACK	1826	0.0394304	0.1946701	0.000000	1.00000	0.00455563	72.00	0.04	493.705
ASIAN	1826	0.0870756	0.2820230	0.000000	1.00000	0.00659985	159.00	0.08	323.883
VRM=1									
INTRST	481	9.9064449	0.1899631	9.0000000	10.50000	0.0086616	4765.000	0.0	1.918
SPREAD	481	-0.0160726	0.0673156	-0.3977000	0.05530	0.0030693	-7.731	0.0	-418.823
LOANAM	481	82604.9209979	45782.5972577	6200.0000000	250000.00000	2087.5067501	39732967.000	2096046211.7	55.424
INCOME	481	2676.9833680	1461.2067771	473.0000000	7000.00000	66.6252942	1287629.000	2135125.2	54.584
AGE	481	37.6112266	9.8073420	20.0000000	67.00000	0.4471763	18091.000	96.2	26.076
SEX	481	0.8918919	0.3108402	0.0000000	1.00000	0.0141731	429.000	0.1	34.852
FDIF	481	-56.5796513	171.4148071	-1038.7100000	530.57600	7.8158424	-27214.812	29383.0	-302.962
SPANISH	481	0.0790021	0.2700228	0.0000000	1.00000	0.0123120	38.000	0.1	341.792
BLACK	481	0.0644491	0.2458068	0.0000000	1.00000	0.0112078	31.000	0.1	381.397
ASIAN	481	0.0769231	0.2667468	0.0000000	1.00000	0.0121626	37.000	0.1	346.771

Logistic Regression - 1979
Sample 'A'

DEPENDENT VARIABLE: VRM

1638 OBSERVATIONS
1122 VRM = 0
516 VRM = 1
0 OBSERVATIONS DELETED DUE TO MISSING VALUES

VARIABLE	MEAN	MINIMUM	MAXIMUM	RANGE
INTRST	11.381	7.75	12.25	4.5
SPREAD	-0.073809	-0.6931	2.1091	2.8022
LOANAM	66971.6	13416.8	268336	254920
FDIF	-52.9718	-1777.25	383.69	2160.94
INCOME	2298.39	439.177	6932.02	6492.84
AGE	36.9127	19	74	55
SEX	0.891941	0	1	1
SPANISH	0.0964591	0	1	1
BLACK	0.0347985	0	1	1*
ASIAN	0.128816	0	1	1

* WARNING: VARIABLE HAS LIMITED DISPERSION.
IT MAY BE A BAD CANDIDATE FOR THE MODEL.

-2 LOG LIKELIHOOD FOR MODEL CONTAINING INTERCEPT ONLY= 2041.14

MODEL CHI-SQUARE= 208.50 WITH 10 D.F. (SCORE STAT.) P=0.0 .
CONVERGENCE OBTAINED IN 6 ITERATIONS. R= 0.319.
MAX ABSOLUTE DERIVATIVE=0.2794D-03. -2 LOG L= 1813.73.
MODEL CHI-SQUARE= 227.40 WITH 10 D.F. (-2 LOG L.R.) P=0.0 .

VARIABLE	BETA	STD. ERROR	CHI-SQUARE	P	R
INTERCEPT	-14.25170945	2.01890326	49.83	0.0000	
INTRST	1.06109462	0.17216129	37.99	0.0000	0.133
SPREAD	0.41351915	0.13005380	10.11	0.0015	0.063
LOANAM	0.00002197	0.00000257	72.86	0.0000	0.186
FDIF	0.00095782	0.00040594	5.57	0.0183	0.042
INCOME	0.00010233	0.00005501	3.46	0.0627	0.027
AGE	-0.00037978	0.00563465	0.01	0.8620	0.000
SEX	-0.32746751	0.18184431	3.24	0.0717	-0.025
SPANISH	-0.08848662	0.20628660	0.18	0.6680	0.000
BLACK	0.19974772	0.30860784	0.42	0.5176	0.000
ASIAN	-0.25322734	0.17896895	2.00	0.1571	-0.001

FRACTION OF CONCORDANT PAIRS OF PREDICTED PROBABILITIES AND RESPONSES :0.709
RANK CORRELATION BETWEEN PREDICTED PROBABILITY AND RESPONSE .0.435

CORRELATION COEFFICIENTS / PROB > |R| UNDER HO:RHO=0 / N = 1638

	VRM	INTRST	SPREAD	LOANAM	INCOME	AGE	SEX	FDIF	SPANISH	BLACK	ASIAN
VRM	1.00000 0.0000	0.18958 0.0001	0.12009 0.0001	0.27557 0.0001	0.19009 0.0001	0.01128 0.6483	-0.02642 0.2852	-0.02133 0.3883	-0.03905 0.1141	0.00032 0.9898	-0.03715 0.1329
INTRST	0.18958 0.0001	1.00000 0.0000	0.24769 0.0001	0.03460 0.1616	0.05234 0.0342	-0.03397 0.1694	-0.02879 0.2443	0.11038 0.0001	0.04484 0.0696	-0.02107 0.3942	-0.03214 0.1935
SPREAD	0.12009 0.0001	0.24769 0.0001	1.00000 0.0000	-0.07526 0.0023	-0.04609 0.0622	-0.00467 0.8501	-0.00613 0.8043	0.24918 0.0001	0.09058 0.0002	0.05510 0.0257	0.01946 0.4312
LOANAM	0.27557 0.0001	0.03460 0.1616	-0.07526 0.0023	1.00000 0.0000	0.52237 0.0001	0.04109 0.0964	0.07591 0.0021	-0.40424 0.0001	-0.15223 0.0001	-0.09609 0.0001	0.02731 0.2693
INCOME	0.19009 0.0001	0.05234 0.0342	-0.04609 0.0622	0.52237 0.0001	1.00000 0.0000	0.15471 0.0001	0.06365 0.0100	-0.20083 0.0001	-0.15724 0.0001	-0.06805 0.0059	-0.07735 0.0017
AGE	0.01128 0.6483	-0.03397 0.1694	-0.00467 0.8501	0.04109 0.0964	0.15471 0.0001	1.00000 0.0000	-0.05593 0.0236	-0.02967 0.2300	-0.04675 0.0586	-0.00604 0.8071	-0.02059 0.4049
SEX	-0.02642 0.2852	-0.02879 0.2443	-0.00613 0.8043	0.07591 0.0021	0.06365 0.0100	-0.05593 0.0236	1.00000 0.0000	-0.03416 0.1670	0.04712 0.0566	-0.06267 0.0112	0.02231 0.3669
FDIF	-0.02133 0.3883	0.11038 0.0001	0.24918 0.0001	-0.40424 0.0001	-0.20083 0.0001	-0.02967 0.2300	-0.03416 0.1670	1.00000 0.0000	0.05670 0.0217	0.03849 0.1195	-0.00712 0.7733
SPANISH	-0.03905 0.1141	0.04484 0.0696	0.09058 0.0002	-0.15223 0.0001	-0.15724 0.0001	-0.04675 0.0586	0.04712 0.0566	0.05670 0.0217	1.00000 0.0000	-0.06204 0.0120	-0.12564 0.0001
BLACK	0.00032 0.9898	-0.02107 0.3942	0.05510 0.0257	-0.09609 0.0001	-0.06805 0.0059	-0.00604 0.8071	-0.06267 0.0112	0.03849 0.1195	-0.06204 0.0120	1.00000 0.0000	-0.07301 0.0031
ASIAN	-0.03715 0.1329	-0.03214 0.1935	0.01946 0.4312	0.02731 0.2693	-0.07735 0.0017	-0.02059 0.4049	0.02231 0.3669	-0.00712 0.7733	-0.12564 0.0001	-0.07301 0.0031	1.00000 0.0000

Correlation Matrix - 1979
Sample 'A'

VARIABLE	N	MEAN	STANDARD DEVIATION	MINIMUM VALUE	MAXIMUM VALUE	STD ERROR OF MEAN	SUM	VARIANCE	C.V.
				VRM=0					
INTRST	1122	11.3105169	0.6245897	7.750000	12.25000	0.01864655	12690.400	0.39	5.522
SPREAD	1122	-0.1106008	0.5295692	-0.693100	2.10910	0.01580980	-124.094	0.28	-478.811
LOANAM	1122	61458.3393123	22560.4947527	13416.815742	175313.05903	673.52262797	68956256.708	508975923.49	36.709
INCOME	1122	2142.2557151	1106.1290484	439.177102	6899.82111	33.02245592	2403610.912	1223521.47	51.634
AGE	1122	36.8324421	10.7823533	19.000000	74.00000	0.32189715	41326.000	116.26	29.274
SEX	1122	0.8975045	0.3034341	0.000000	1.00000	0.00905874	1007.000	0.09	33.809
FDIF	1122	-50.4986543	155.0628165	-818.166369	383.69052	4.62925644	-56659.490	24044.48	-307.063
SPANISH	1122	0.1042781	0.3057572	0.000000	1.00000	0.00912810	117.000	0.09	293.213
BLACK	1122	0.0347594	0.1832514	0.000000	1.00000	0.00547080	39.000	0.03	527.200
ASIAN	1122	0.1372549	0.3442697	0.000000	1.00000	0.01027785	154.000	0.12	250.825
				VRM=1					
INTRST	516	11.5343992	0.2713528	9.750000	12.25000	0.0119456	5951.750	0.1	2.353
SPREAD	516	0.0061919	0.1713178	-0.693100	0.11890	0.0075418	3.195	0.0	2766.822
LOANAM	516	78959.8154234	38081.1810850	17889.087657	268336.31485	1676.4305200	40743264.758	1450176352.8	48.229
INCOME	516	2637.8811832	1354.2194430	447.227191	6932.02147	59.6161868	1361146.691	1833910.3	51.337
AGE	516	37.0872093	9.8547781	20.000000	69.00000	0.4338324	19137.000	97.1	26.572
SEX	516	0.8798450	0.3254583	0.000000	1.00000	0.0143275	454.000	0.1	36.990
FDIF	516	-58.3495864	201.4746937	-1777.254025	168.38640	8.8694288	-30108.387	40592.1	-345.289
SPANISH	516	0.0794574	0.2707137	0.000000	1.00000	0.0119175	41.000	0.1	340.703
BLACK	516	0.0348837	0.1836633	0.000000	1.00000	0.0080853	18.000	0.0	526.502
ASIAN	516	0.1104651	0.3137728	0.000000	1.00000	0.0138131	57.000	0.1	284.047

Logistic Regression - 1980
Sample 'A'

DEPENDENT VARIABLE: VRM

1671 OBSERVATIONS
1241 VRM = 0
430 VRM = 1
0 OBSERVATIONS DELETED DUE TO MISSING VALUES

VARIABLE	MEAN	MINIMUM	MAXIMUM	RANGE
INTRST	12.1587	8.35	14.5	6.15
SPREAD	-0.07311	-0.3621	0.5224	0.8845
LOANAM	77918	11904.8	238095	226190
FDIF	114.698	-1271.57	670.167	1941.74
INCOME	2580.19	436.508	6995.23	6558.73
AGE	36.9108	20	73	53
SEX	0.894674	0	1	1
SPANISH	0.0771993	0	1	1
BLACK	0.0365051	0	1	1*
ASIAN	0.143627	0	1	1

* WARNING: VARIABLE HAS LIMITED DISPERSION.
IT MAY BE A BAD CANDIDATE FOR THE MODEL.

-2 LOG LIKELIHOOD FOR MODEL CONTAINING INTERCEPT ONLY= 1905.76

MODEL CHI-SQUARE= 188.98 WITH 10 D.F. (SCORE STAT.) P=0.0 .
CONVERGENCE OBTAINED IN 5 ITERATIONS. R= 0.291.
MAX ABSOLUTE DERIVATIVE=0.692RD-03. -2 LOG L= 1724.80.
MODEL CHI-SQUARE= 180.97 WITH 10 D.F. (-2 LOG L.R.) P=0.0 .

VARIABLE	BETA	STD. ERROR	CHI-SQUARE	P	R
INTERCEPT	-3.18173597	1.01946401	9.74	0.0018	
INTRST	0.09495039	0.08088479	1.38	0.2404	0.000
SPREAD	0.14159420	0.25170522	0.32	0.5737	0.000
LOANAM	0.00001328	0.00000253	27.48	0.0000	0.116
FDIF	-0.00125860	0.00031808	15.66	0.0001	-0.085
INCOME	0.00011387	0.00005480	4.32	0.0377	0.035
AGE	-0.00250273	0.00620472	0.16	0.6867	0.000
SEX	-0.26042237	0.19522931	1.78	0.1822	0.000
SPANISH	-0.04175282	0.26862129	0.02	0.8765	0.000
BLACK	0.32395234	0.33937490	0.44	0.5093	0.000
ASIAN	0.05708059	0.17205044	0.11	0.7401	0.000

FRACTION OF CONCORDANT PAIRS OF PREDICTED PROBABILITIES AND RESPONSES :0.670
RANK CORRELATION BETWEEN PREDICTED PROBABILITY AND RESPONSE :0.363

Correlation Matrix - 1980
Sample 'A'

CORRELATION COEFFICIENTS / PROB > |R| UNDER HO:RHO=0 / N = 1671

	VRM	INTRST	SPREAD	LOANAM	INCOME	AGE	SEX	FDIF	SPANISH	BLACK	ASIAN
VRM	1.00000	0.03120	-0.00187	0.31203	0.24191	0.03049	0.00575	-0.27084	-0.06768	-0.01969	-0.00687
	0.0000	0.2024	0.9391	0.0001	0.0001	0.2129	0.8142	0.0001	0.0056	0.4212	0.7791
INTRST	0.03120	1.00000	-0.47563	0.06667	0.09771	-0.01450	0.05155	0.10915	0.05031	0.00492	-0.01583
	0.2024	0.0000	0.0001	0.0064	0.0001	0.5535	0.0351	0.0001	0.0398	0.8408	0.5179
SPREAD	-0.00187	-0.47563	1.00000	-0.10712	-0.10286	-0.00962	-0.03892	-0.18607	-0.02356	0.09383	0.03847
	0.9391	0.0001	0.0000	0.0001	0.0001	0.6944	0.1117	0.0001	0.3358	0.0001	0.1159
LOANAM	0.31203	0.06667	-0.10712	1.00000	0.63906	0.08257	0.10789	-0.60778	-0.21183	-0.12466	-0.01684
	0.0001	0.0064	0.0001	0.0000	0.0001	0.0007	0.0001	0.0001	0.0001	0.0001	0.4916
INCOME	0.24191	0.09771	-0.10286	0.63906	1.00000	0.20483	0.08646	-0.40761	-0.18983	-0.09305	-0.09555
	0.0001	0.0001	0.0001	0.0001	0.0000	0.0001	0.0004	0.0001	0.0001	0.0001	0.0001
AGE	0.03049	-0.01450	-0.00962	0.08257	0.20483	1.00000	0.02039	-0.08149	-0.04864	-0.05167	-0.00027
	0.2129	0.5535	0.6944	0.0007	0.0001	0.0000	0.4049	0.0009	0.0468	0.0347	0.9912
SEX	0.00575	0.05155	-0.03892	0.10789	0.08646	0.02039	1.00000	-0.08479	0.06272	-0.03716	0.02378
	0.8142	0.0351	0.1117	0.0001	0.0004	0.4049	0.0000	0.0005	0.0103	0.1289	0.3313
FDIF	-0.27084	0.10915	-0.18607	-0.60778	-0.40761	-0.08149	-0.08479	1.00000	0.15149	0.09763	0.01501
	0.0001	0.0001	0.0001	0.0001	0.0001	0.0009	0.0005	0.0000	0.0001	0.0001	0.5398
SPANISH	-0.06768	0.05031	-0.02356	-0.21183	-0.18983	-0.04864	0.06272	0.15149	1.00000	-0.05630	-0.11845
	0.0056	0.0398	0.3358	0.0001	0.0001	0.0468	0.0103	0.0001	0.0000	0.0214	0.0001
BLACK	-0.01969	0.00492	0.09383	-0.12466	-0.09305	-0.05167	-0.03716	0.09763	-0.05630	1.00000	-0.07971
	0.4212	0.8408	0.0001	0.0001	0.0001	0.0347	0.1289	0.0001	0.0214	0.0000	0.0011
ASIAN	-0.00687	-0.01583	0.03847	-0.01684	-0.09555	-0.00027	0.02378	-0.01501	-0.11845	-0.07971	1.00000
	0.7791	0.5179	0.1159	0.4916	0.0001	0.9912	0.3313	0.5398	0.0001	0.0011	0.0000

Descriptive Statistics - 1980 Sample 'A'

VARIABLE	N	MEAN	STANDARD DEVIATION	MINIMUM VALUE	MAXIMUM VALUE	STD ERROR OF MEAN	SUM	VARIANCE	C.V.
VRM=0									
INTRST	1241	12.1429855	0.8599166	8.350000	14.50000	0.02441015	15069.445	0.74	7.082
SPREAD	1241	-0.0727973	0.2886693	-0.362100	0.52240	0.00819435	-90.341	0.08	-396.539
LOANAM	1241	71743.8957318	28259.0098851	11904.761905	238095.23810	802.17856051	89034174.603	798571639.69	39.389
INCOME	1241	2385.7846335	1210.1495868	436.507937	6904.76190	34.35209009	2960758.730	1464462.02	50.723
AGE	1241	36.7284448	10.2847164	20.000000	73.00000	0.29194862	45580.000	105.78	28.002
SEX	1241	0.8936347	0.3084296	0.000000	1.00000	0.00875528	1109.000	0.10	34.514
FDIF	1241	150.9944506	187.0121287	-637.015873	670.16667	5.30864743	187384.113	34973.54	123.854
SPANISH	1241	0.0878324	0.2831651	0.000000	1.00000	0.00803811	109.000	0.08	322.393
BLACK	1241	0.0386785	0.1929053	0.000000	1.00000	0.00547593	48.000	0.04	498.741
ASIAN	1241	0.1450443	0.3522875	0.000000	1.00000	0.01000026	180.000	0.12	242.883
VRM=1									
INTRST	430	12.2040698	0.8442185	9.750000	14.00000	0.0407118	5247.750	0.7	6.918
SPREAD	430	-0.0740128	0.2717901	-0.362100	0.52240	0.0131069	-31.825	0.1	-367.220
LOANAM	430	95736.9416759	40800.8880628	25396.825397	238095.23810	1967.5935406	41166884.921	1664712466.7	42.618
INCOME	430	3141.2384644	1613.0070341	592.063492	6995.23810	77.7861064	1350732.540	2601791.7	51.349
AGE	430	37.4372093	9.8110119	20.000000	66.00000	0.4731290	16098.000	96.3	26.207
SEX	430	0.8976744	0.3034290	0.000000	1.00000	0.0146326	386.000	0.1	33.802
FDIF	430	9.9438852	293.2516383	-1271.571429	647.88095	14.1418498	4275.871	85996.5	2949.065
SPANISH	430	0.0465116	0.2108357	0.000000	1.00000	0.0101674	20.000	0.0	453.297
BLACK	430	0.0302326	0.1714261	0.000000	1.00000	0.0082669	13.000	0.0	567.025
ASIAN	430	0.1395349	0.3469074	0.000000	1.00000	0.0167294	60.000	0.1	248.617

Logistic Regression - 1981
Sample 'A'

DEPENDENT VARIABLE: VRM

498 OBSERVATIONS
353 VRM = 0
145 VRM = 1
0 OBSERVATIONS DELETED DUE TO MISSING VALUES

VARIABLE	MEAN	MINIMUM	MAXIMUM	RANGE
INTRST	14.2896	9.75	18	8.25
SPREAD	-0.421669	-0.99	0.487	1.477
LOANAM	58952.6	14306.1	214592	200286
FDIF	563.377	-1039.94	3624.44	4664.38
INCOME	2325.84	500.715	6937.77	6437.05
AGE	37.4478	19	72	53
SEX	0.861446	0	1	1
SPANISH	0.064257	0	1	1
BLACK	0.0542169	0	1	1
ASIAN	0.11245	0	1	1

-2 LOG LIKELIHOOD FOR MODEL CONTAINING INTERCEPT ONLY= 600.78

MODEL CHI-SQUARE= 139.74 WITH 10 D.F. (SCORE STAT.) P=0.0 .
CONVERGENCE OBTAINED IN 6 ITERATIONS. R= 0.465.
MAX ABSOLUTE DERIVATIVE=0.1475D-03. -2 LOG L= 450.95.
MODEL CHI-SQUARE= 149.83 WITH 10 D.F. (-2 LOG L.R.) P=0.0 .

VARIABLE	BETA	STD. ERROR	CHI-SQUARE	P	R
INTERCEPT	0.71664778	1.03149079	0.48	0.4872	
INTRST	-0.11746280	0.06439752	3.33	0.0681	-0.047
SPREAD	5.07020607	0.65861919	59.26	0.0000	0.309
LOANAM	-0.00000978	0.00000700	1.95	0.1622	0.000
FDIF	0.00153055	0.00033850	20.44	0.0000	0.175
INCOME	-0.00014247	0.00013697	1.08	0.2983	0.000
AGE	0.03927240	0.00987090	15.83	0.0001	0.152
SEX	0.51557830	0.36256730	2.02	0.1550	0.006
SPANISH	0.78473282	0.45698296	2.95	0.0859	0.040
BLACK	0.26342187	0.56704426	0.22	0.6423	0.000
ASIAN	-0.07232386	0.40753475	0.03	0.8591	0.000

FRACTION OF CONCORDANT PAIRS OF PREDICTED PROBABILITIES AND RESPONSES :0.833
RANK CORRELATION BETWEEN PREDICTED PROBABILITY AND RESPONSE :0.675

CORRELATION COEFFICIENTS / PROB > |R| UNDER HO:RHO=0 / N = 498

	VRM	INTRST	SPREAD	LOANAM	INCOME	AGE	SEX	FDIF	SPANISH	BLACK	ASIAN
VRM	1.00000 0.0000	-0.20421 0.0001	0.41915 0.0001	-0.02949 0.5114	-0.11675 0.0091	0.11441 0.0106	0.05233 0.2437	-0.23048 0.0001	0.03033 0.4995	-0.03633 0.4185	0.00972 0.8287
INTRST	-0.20421 0.0001	1.00000 0.0000	-0.32746 0.0001	0.04657 0.2996	0.31015 0.0001	0.00845 0.8508	0.02665 0.5530	0.29050 0.0001	0.05107 0.2553	0.04381 0.3292	0.04280 0.3405
SPREAD	0.41915 0.0001	-0.32746 0.0001	1.00000 0.0000	-0.07345 0.1016	-0.19705 0.0001	-0.10162 0.0233	-0.02513 0.5758	-0.82630 0.0001	-0.01292 0.7737	-0.08560 0.0563	0.04120 0.3589
LOANAM	-0.02949 0.5114	0.04657 0.2996	-0.07345 0.1016	1.00000 0.0000	0.57180 0.0001	0.03226 0.4726	0.11701 0.0090	0.40671 0.0001	-0.12327 0.0059	-0.10244 0.0222	0.02694 0.5487
INCOME	-0.11675 0.0091	0.31015 0.0001	-0.19705 0.0001	0.57180 0.0001	1.00000 0.0000	0.13635 0.0023	0.12510 0.0052	0.35243 0.0001	-0.08508 0.0578	-0.08434 0.0600	-0.02164 0.6300
AGE	0.11444 0.0106	0.00845 0.8508	-0.10162 0.0233	0.03226 0.4726	0.13635 0.0023	1.00000 0.0000	-0.09003 0.0446	0.10169 0.0232	-0.04453 0.3214	-0.01630 0.7166	-0.08257 0.0656
SEX	0.05233 0.2437	0.02665 0.5530	-0.02513 0.5758	0.11701 0.0090	0.12510 0.0052	-0.09003 0.0446	1.00000 0.0000	0.09675 0.0309	0.03398 0.4492	-0.05798 0.1964	-0.02283 0.6113
FDIF	-0.23048 0.0001	0.29050 0.0001	-0.82630 0.0001	0.40671 0.0001	0.35243 0.0001	0.10169 0.0232	0.09675 0.0309	1.00000 0.0000	-0.05353 0.2331	0.03276 0.4657	0.01270 0.7774
SPANISH	0.03033 0.4995	0.05107 0.2553	-0.01292 0.7737	-0.12327 0.0059	-0.08508 0.0578	-0.04453 0.3214	0.03398 0.4492	-0.05353 0.2331	1.00000 0.0000	-0.06274 0.1621	-0.09327 0.0375
BLACK	-0.03633 0.4185	0.04381 0.3292	-0.08560 0.0563	-0.10244 0.0222	-0.08434 0.0600	-0.01630 0.7166	-0.05798 0.1964	0.03276 0.4657	-0.06274 0.1621	1.00000 0.0000	-0.08522 0.0574
ASIAN	0.00972 0.8287	0.04280 0.3405	0.04120 0.3589	0.02694 0.5487	-0.02164 0.6300	-0.08257 0.0656	-0.02283 0.6113	0.01270 0.7774	-0.09327 0.0375	-0.08522 0.0574	1.00000 0.0000

Correlation Matrix - 1981
Sample 'A'

Descriptive Statistics - 1981 Sample 'A'

VARIABLE	N	MEAN	STANDARD DEVIATION	MINIMUM VALUE	MAXIMUM VALUE	STD ERROR OF MEAN	SUM	VARIANCE	C.V.
VRM=0									
INTRST	353	14.5725637	2.2444702	9.750000	18.00000	0.1194611	5144.115	5.04	15.402
SPRLAD	353	-0.5404207	0.4155157	-0.990000	0.48700	0.0221157	-190.768	0.17	-76.887
LOANAM	353	59460.6621357	29478.8412990	14306.151645	214592.27468	1569.0004074	20989613.734	869002084.33	49.577
INCOME	353	2420.4853554	1354.2683612	500.715308	6937.76824	72.0804318	854431.330	1834042.79	55.950
AGE	353	36.5665722	11.0762704	19.000000	71.00000	0.5895304	12908.000	122.68	30.291
SEX	353	0.8498584	0.3577172	0.000000	1.00000	0.0190394	300.000	0.13	42.091
FDIF	353	691.6970841	965.3154299	-742.662403	3624.44206	51.3785561	244169.071	931833.88	139.558
SPANISH	353	0.0594901	0.2368754	0.000000	1.00000	0.0126076	21.000	0.06	398.176
BLACK	353	0.0594901	0.2368754	0.000000	1.00000	0.0126076	21.000	0.06	398.176
ASIAN	353	0.1104816	0.3139341	0.000000	1.00000	0.0167090	39.000	0.10	284.151
VRM=1									
INTRST	145	13.6008621	1.7812376	11.500000	17.25000	0.1179237	1972.1250	3.17	13.097
SPREAD	145	-0.1325703	0.3674742	-0.990000	0.48700	0.0305171	-19.2227	0.14	-277.192
LOANAM	145	57715.7022347	19300.5444885	18597.997139	144206.00858	1602.8229785	8368776.8240	372511017.55	33.441
INCOME	145	2095.4417641	986.7800744	575.107296	6096.56652	81.9476248	303839.0558	973734.92	47.092
AGE	145	39.5931034	13.8851922	22.000000	72.00000	1.1531025	5741.0000	192.80	35.070
SEX	145	0.8896552	0.3144051	0.000000	1.00000	0.0261099	129.0000	0.10	35.340
FDIF	145	250.9849909	439.6419190	-1039.935622	2222.08155	36.5102741	36392.8237	193285.02	175.167
SPANISH	145	0.0758621	0.2656951	0.000000	1.00000	0.0220648	11.0000	0.07	350.234
BLACK	145	0.0413793	0.1998563	0.000000	1.00000	0.0165972	6.0000	0.04	482.986
ASIAN	145	0.1172414	0.3228228	0.000000	1.00000	0.0268090	17.0000	0.10	275.349

Logistic Regression - 1978
Sample 'AA'

DEPENDENT VARIABLE: VRM

2305 OBSERVATIONS
1811 VRM = 0
494 VRM = 1
0 OBSERVATIONS DELETED DUE TO MISSING VALUES

VARIABLE	MEAN	MINIMUM	MAXIMUM	RANGE
INTRST	9.89043	7.5	10.5	3
SPREAD	-0.0413855	-0.3977	0.6634	1.0611
LOANAM	64899.3	9000	250000	241000
FDIF	16.9084	-2358.27	1017.43	3375.7
INCOME	2737.03	425	7000	6575
AGE	37.2282	19	75	56
SEX	0.879826	0	1	1
SPANISH	0.0941432	0	1	1
BLACK	0.0420824	0	1	1*
ASIAN	0.0841649	0	1	1

* WARNING: VARIABLE HAS LIMITED DISPERSION.
IT MAY BE A BAD CANDIDATE FOR THE MODEL.

-2 LOG LIKELIHOOD FOR MODEL CONTAINING INTERCEPT ONLY= 2395.45

MODEL CHI-SQUARE= 352.74 WITH 10 D.F. (SCORE STAT.) P=0.0 .
CONVERGENCE OBTAINED IN 6 ITERATIONS. R= 0.366.
MAX ABSOLUTE DERIVATIVE=0.6727D-04. -2 LOG L= 2054.15.
MODEL CHI-SQUARE= 341.30 WITH 10 D.F. (-2 LOG L.R.) P=0.0 .

VARIABLE	BETA	STD. ERROR	CHI-SQUARE	P	R
INTERCEPT	-6.75302254	2.54717807	7.03	0.0080	
INTRST	0.42915286	0.25502938	2.83	0.0924	0.019
SPREAD	2.32125473	0.33720318	47.39	0.0000	0.138
LOANAM	0.00001264	0.00000287	19.37	0.0000	0.085
FDIF	-0.00466209	0.00077040	36.62	0.0000	-0.120
INCOME	0.00007412	0.00005715	1.68	0.1947	0.000
AGE	0.01051915	0.00560297	3.52	0.0605	0.025
SEX	-0.24642297	0.17260002	2.04	0.1534	-0.004
SPANISH	0.24525859	0.20236282	1.47	0.2255	0.000
BLACK	0.61255359	0.25388797	5.82	0.0158	0.040
ASIAN	-0.17560738	0.21136382	0.69	0.4061	0.000

FRACTION OF CONCORDANT PAIRS OF PREDICTED PROBABILITIES AND RESPONSES :0.727
RANK CORRELATION BETWEEN PREDICTED PROBABILITY AND RESPONSE :0.476

Correlation Matrix - 1978
Sample 'AA'

CORRELATION COEFFICIENTS / PROB > |R| UNDER HO:RHO=0 / N = 2305

	VRM	INTRST	SPREAD	LOANAM	INCOME	AGE	SEX	FDIF	SPANISH	BLACK	ASIAN
VRM	1.00000	0.02742	0.10888	0.34760	0.24707	0.06119	0.00444	-0.29496	-0.02718	0.02744	-0.02124
	0.0000	0.1882	0.0001	0.0001	0.0001	0.0033	0.8313	0.0001	0.1921	0.1878	0.3081
INTRST	0.02742	1.00000	-0.01156	0.00382	0.02617	-0.02557	0.00882	0.01554	0.04146	0.06288	-0.02585
	0.1882	0.0000	0.5792	0.8547	0.2092	0.2198	0.6723	0.4558	0.0466	0.0025	0.2148
SPREAD	0.10888	-0.01156	1.00000	-0.01347	-0.00367	-0.01041	-0.02181	0.06679	0.03277	-0.01694	0.00585
	0.0001	0.5792	0.0000	0.5180	0.8602	0.6176	0.2952	0.0013	0.1157	0.4162	0.7789
LOANAM	0.34760	0.00382	-0.01347	1.00000	0.64035	0.05634	0.10352	-0.63589	-0.15047	-0.06692	0.02445
	0.0001	0.8547	0.5180	0.0000	0.0001	0.0068	0.0001	0.0001	0.0001	0.0013	0.2406
INCOME	0.24707	0.02617	-0.00367	0.64035	1.00000	0.21145	0.10811	-0.37684	-0.15512	-0.06312	-0.06421
	0.0001	0.2092	0.8602	0.0001	0.0000	0.0001	0.0001	0.0001	0.0001	0.0024	0.0020
AGE	0.06119	-0.02557	-0.01041	0.05634	0.21145	1.00000	-0.07548	-0.00579	-0.05603	0.00456	-0.00849
	0.0033	0.2198	0.6176	0.0068	0.0001	0.0000	0.0003	0.7813	0.0071	0.8267	0.6837
SEX	0.00444	0.00882	-0.02181	0.10352	0.10811	-0.07548	1.00000	-0.08950	0.06889	-0.04215	0.02073
	0.8313	0.6723	0.2952	0.0001	0.0001	0.0003	0.0000	0.0001	0.0009	0.0430	0.3198
FDIF	-0.29496	0.01554	0.06679	-0.63589	-0.37684	-0.00579	-0.08950	1.00000	0.09186	0.01794	-0.01901
	0.0001	0.4558	0.0013	0.0001	0.0001	0.7813	0.0001	0.0000	0.0001	0.3894	0.3615
SPANISH	-0.02718	0.04146	0.03277	-0.15047	-0.15512	-0.05603	0.06889	0.09186	1.00000	-0.06757	-0.09773
	0.1921	0.0466	0.1157	0.0001	0.0001	0.0071	0.0009	0.0001	0.0000	0.0012	0.0001
BLACK	0.02744	0.06288	-0.01694	-0.06692	-0.06312	0.00456	-0.04215	0.01794	-0.06757	1.00000	-0.06354
	0.1878	0.0025	0.4162	0.0013	0.0024	0.8267	0.0430	0.3894	0.0012	0.0000	0.0023
ASIAN	-0.02124	-0.02585	0.00585	0.02445	-0.06421	-0.00849	0.02073	-0.01901	-0.09773	-0.06354	1.00000
	0.3081	0.2148	0.7789	0.2406	0.0020	0.6837	0.3198	0.3615	0.0001	0.0023	0.0000

Descriptive Statistics - 1978 Sample 'AA'

VARIABLE	N	MEAN	STANDARD DEVIATION	MINIMUM VALUE	MAXIMUM VALUE	STD ERROR OF MEAN	SUM	VARIANCE	C.V.
VRM=0									
INTRST	1811	9.8868029	0.2676513	7.500000	10.25000	0.00628941	17905.00	0.07	2.707
SPREAD	1811	-0.0496913	0.1577828	-0.397700	0.66340	0.00370767	-89.99	0.02	-317.526
LOANAM	1811	59161.0353396	21343.0312120	11200.000000	180000.00000	501.52995153	107140635.00	455524981.32	36.076
INCOME	1811	2080.0596356	1032.1955572	475.000000	7000.00000	24.25508273	3766988.00	1065427.67	49.623
AGE	1811	36.8972943	10.4692366	19.000000	75.00000	0.24601172	66821.00	109.60	28.374
SEX	1811	0.8790723	0.3261332	0.000000	1.00000	0.00766365	1592.00	0.11	37.100
FDIF	1811	39.9688487	119.9995070	-639.230000	1017.43500	2.81981253	72383.59	14399.88	300.233
SPANISH	1811	0.0982882	0.2977862	0.000000	1.00000	0.00699754	178.00	0.09	302.972
BLACK	1811	0.0392049	0.1941356	0.000000	1.00000	0.00456190	71.00	0.04	495.183
ASIAN	1811	0.0872446	0.2822711	0.000000	1.00000	0.00663296	158.00	0.08	323.540
VRM=1									
INTRST	494	9.9037449	0.1932262	8.7500000	10.50000	0.0086937	4892.450	0.0	1.951
SPREAD	494	-0.0109362	0.0845916	-0.3977000	0.66340	0.0038060	-5.402	0.0	-773.498
LOANAM	494	85935.6255061	49337.1075763	9000.0000000	250000.00000	2219.7814132	42452199.000	2434150184.0	57.412
INCOME	494	2812.4939271	1607.7533740	453.0000000	7000.00000	72.3362441	1389372.000	2584870.9	57.165
AGE	494	38.4412955	9.8503815	22.0000000	75.00000	0.4431896	18990.000	97.0	25.624
SEX	494	0.8825911	0.3222332	0.0000000	1.00000	0.0144980	436.000	0.1	36.510
FDIF	494	-67.6310195	206.8482161	-2358.2700000	570.20000	9.3065412	-33409.724	42786.2	-305.848
SPANISH	494	0.0789474	0.2699299	0.0000000	1.00000	0.0121447	39.000	0.1	341.911
BLACK	494	0.0526316	0.2235232	0.0000000	1.00000	0.0100568	26.000	0.0	424.694
ASIAN	494	0.0728745	0.2601939	0.0000000	1.00000	0.0117067	36.000	0.1	357.044

Logistic Regression - 1979
Sample 'AA'

DEPENDENT VARIABLE: VRM

1629 OBSERVATIONS
1112 VRM = 0
517 VRM = 1
0 OBSERVATIONS DELETED DUE TO MISSING VALUES

VARIABLE	MEAN	MINIMUM	MAXIMUM	RANGE
INTRST	11.363	7.75	12.5	4.75
SPREAD	-0.0513307	-0.6931	2.1091	2.8022
LOANAM	68247.4	12969.6	268336	255367
FDIF	-56.6373	-1959.94	730.295	2690.23
INCOME	2367.17	447.227	6976.74	6529.52
AGE	37.5967	19	74	55
SEX	0.884592	0	1	1
SPANISH	0.0939227	0	1	1
BLACK	0.0325353	0	1	1*
ASIAN	0.116022	0	1	1

* WARNING: VARIABLE HAS LIMITED DISPERSION.
IT MAY BE A BAD CANDIDATE FOR THE MODEL.

-2 LOG LIKELIHOOD FOR MODEL CONTAINING INTERCEPT ONLY= 2035.84

MODEL CHI-SQUARE= 162.47 WITH 10 D.F. (SCORE STAT.) P=0.0 .
CONVERGENCE OBTAINED IN 6 ITERATIONS. R= 0.280.
MAX ABSOLUTE DERIVATIVE=0.1032D-03. -2 LOG L= 1856.45.
MODEL CHI-SQUARE= 179.39 WITH 10 D.F. (-2 LOG L.R.) P=0.0 .

VARIABLE	BETA	STD. ERROR	CHI-SQUARE	P	R
INTERCEPT	-14.10630526	1.95288121	52.18	0.0000	
INTRST	1.05432374	0.16645612	40.12	0.0000	0.137
SPREAD	0.25038843	0.12242091	4.18	0.0408	0.033
LOANAM	0.00001862	0.00000254	53.60	0.0000	0.159
FDIF	0.00058731	0.00038394	2.34	0.1261	0.013
INCOME	-0.00000589	0.00005720	0.01	0.9179	0.000
AGE	0.01024933	0.00555727	3.40	0.0651	0.026
SEX	-0.45882364	0.17390885	6.96	0.0083	-0.049
SPANISH	0.41339155	0.19554401	4.47	0.0345	0.035
BLACK	0.20112662	0.33067475	0.37	0.5430	0.000
ASIAN	0.08890225	0.17905215	0.25	0.6195	0.000

FRACTION OF CONCORDANT PAIRS OF PREDICTED PROBABILITIES AND RESPONSES 0.684
RANK CORRELATION BETWEEN PREDICTED PROBABILITY AND RESPONSE 0.389

Correlation Matrix - 1979
Sample 'AA'

CORRELATION COEFFICIENTS / PROB > |R| UNDER HO RHO=0 / N = 1629

	VRM	INTRST	SPREAD	LOANAM	INCOME	AGE	SEX	FDIF	SPANISH	BLACK	ASIAN
VRM	1.00000	0.18905	0.10359	0.23354	0.15271	0.03953	-0.03027	-0.02584	0.01104	-0.01353	0.00007
	0.0000	0.0001	0.0001	0.0001	0.0001	0.1108	0.2220	0.2972	0.6561	0.5851	0.9978
INTRST	0.18905	1.00000	0.22277	0.05497	0.09392	-0.06992	0.00971	0.13951	0.02843	-0.07725	-0.03335
	0.0001	0.0000	0.0001	0.0265	0.0001	0.0047	0.6955	0.0001	0.2514	0.0018	0.1785
SPREAD	0.10359	0.22277	1.00000	-0.03478	-0.00394	0.02110	0.01020	0.30923	0.03160	0.00022	-0.00986
	0.0001	0.0001	0.0000	0.1606	0.8736	0.3947	0.6808	0.0001	0.2024	0.9930	0.6909
LOANAM	0.23354	0.05497	-0.03478	1.00000	0.59851	0.04854	0.12570	-0.43393	-0.16293	-0.08892	0.01754
	0.0001	0.0265	0.1606	0.0000	0.0001	0.0501	0.0001	0.0001	0.0001	0.0003	0.4793
INCOME	0.15271	0.09392	-0.00394	0.59851	1.00000	0.18689	0.12500	-0.19409	-0.17150	-0.08570	-0.05438
	0.0001	0.0001	0.8736	0.0001	0.0000	0.0001	0.0001	0.0001	0.0001	0.0005	0.0282
AGE	0.03953	-0.06992	0.02110	0.04854	0.18689	1.00000	0.03320	-0.01444	-0.04869	-0.00253	0.01861
	0.1108	0.0047	0.3947	0.0501	0.0001	0.0000	0.1805	0.5604	0.0494	0.9187	0.4529
SEX	-0.03027	0.00971	0.01020	0.12570	0.12500	0.03320	1.00000	-0.05648	0.05043	-0.07454	0.03487
	0.2220	0.6955	0.6808	0.0001	0.0001	0.1805	0.0000	0.0226	0.0418	0.0026	0.1595
FDIF	-0.02584	0.13951	0.30923	-0.43393	-0.19409	-0.01444	-0.05648	1.00000	0.05245	0.07672	-0.03157
	0.2972	0.0001	0.0001	0.0001	0.0001	0.5604	0.0226	0.0000	0.0343	0.0019	0.2028
SPANISH	0.01104	0.02843	0.03160	-0.16293	-0.17150	-0.04869	0.05043	0.05245	1.00000	-0.05904	-0.11664
	0.6561	0.2514	0.2024	0.0001	0.0001	0.0494	0.0418	0.0343	0.0000	0.0172	0.0001
BLACK	-0.01353	-0.07725	0.00022	-0.08892	-0.08570	-0.00253	-0.07454	0.07672	-0.05904	1.00000	-0.06644
	0.5851	0.0018	0.9930	0.0003	0.0005	0.9187	0.0026	0.0019	0.0172	0.0000	0.0073
ASIAN	0.00007	-0.03335	-0.00986	0.01754	-0.05438	0.01861	0.03487	-0.03157	-0.11664	-0.06644	1.00000
	0.9978	0.1785	0.6909	0.4793	0.0282	0.4529	0.1595	0.2028	0.0001	0.0073	0.0000

Descriptive Statistics - 1979 Sample 'AA'

VARIABLE	N	MEAN	STANDARD DEVIATION	MINIMUM VALUE	MAXIMUM VALUE	STD ERROR OF MEAN	SUM	VARIANCE	C.V.
VRM=0									
INTRST	1112	11.2908948	0.6279357	7.750000	12.25000	0.01883054	12555.475	0.39	5.561
SPREAD	1112	-0.0853799	0.5731220	-0.693100	2.10910	0.01718679	-94.942	0.33	-671.261
LOANAM	1112	63226.8889718	24420.9805583	17441.860465	223166.36852	732.33654070	70308300.537	596384291.43	38.624
INCOME	1112	2237.3963977	1129.1517281	447.227191	6875.67084	33.86101015	2487984.794	1274983.63	50.467
AGE	1112	37.3156475	10.3767121	20.000000	74.00000	0.31117692	41495.000	107.68	27.808
SEX	1112	0.8911871	0.3115445	0.000000	1.00000	0.00934260	991.000	0.10	34.958
FDIF	1112	-53.4076870	163.0622338	-796.853309	730.29517	4.88991144	-59389.348	26589.29	-305.316
SPANISH	1112	0.0917266	0.2887695	0.000000	1.00000	0.00865962	102.000	0.08	314.815
BLACK	1112	0.0341727	0.1817542	0.000000	1.00000	0.00545045	38.000	0.03	531.870
ASIAN	1112	0.1160072	0.3203776	0.000000	1.00000	0.00960749	129.000	0.10	276.170
VRM=1									
INTRST	517	11.5181238	0.3221659	9.470000	12.50000	0.0141688	5954.870	0.1	2.797
SPREAD	517	0.0219050	0.1360665	-0.693100	0.11890	0.0059842	11.325	0.0	621.166
LOANAM	517	79046.0220136	41024.4375762	12969.588551	268336.31485	1804.2527016	40866793.381	1683004478.4	51.899
INCOME	517	2646.2839486	1429.5699048	447.227191	6976.74419	62.8724125	1368128.801	2043670.1	54.022
AGE	517	38.2011605	10.5300492	19.000000	70.00000	0.4631110	19750.000	110.9	27.565
SEX	517	0.8704062	0.3361813	0.000000	1.00000	0.0147852	450.000	0.1	38.623
FDIF	517	-63.5837643	220.7237111	-1959.937388	395.96601	9.7074177	-32872.806	48719.0	-347.138
SPANISH	517	0.0986460	0.2984750	0.000000	1.00000	0.0131269	51.000	0.1	302.572
BLACK	517	0.0290135	0.1680070	0.000000	1.00000	0.0073889	15.000	0.0	579.064
ASIAN	517	0.1160542	0.3206001	0.000000	1.00000	0.0141000	60.000	0.1	276.250

Logistic Regression - 1980
Sample 'AA'

DEPENDENT VARIABLE: VRM

1701 OBSERVATIONS
1267 VRM = 0
434 VRM = 1
0 OBSERVATIONS DELETED DUE TO MISSING VALUES

VARIABLE	MEAN	MINIMUM	MAXIMUM	RANGE
INTRST	12.1478	8.35	14.25	5.9
SPREAD	-0.0653815	-0.3621	0.5224	0.8845
LOANAM	76630.6	10158.7	238095	227936
FDIF	118.04	-893.293	670.167	1563.46
INCOME	2575.39	436.508	6984.13	6547.62
AGE	36.6296	19	70	51
SEX	0.881246	0	1	1
SPANISH	0.0787772	0	1	1
BLACK	0.0299824	0	1	1*
ASIAN	0.12522	0	1	1

* WARNING: VARIABLE HAS LIMITED DISPERSION.
IT MAY BE A BAD CANDIDATE FOR THE MODEL.

-2 LOG LIKELIHOOD FOR MODEL CONTAINING INTERCEPT ONLY= 1932.05

MODEL CHI-SQUARE= 151.29 WITH 10 D.F. (SCORE STAT.) P=0.0 .
CONVERGENCE OBTAINED IN 5 ITERATIONS. R= 0.255.
MAX ABSOLUTE DERIVATIVE=0.1938D-03. -2 LOG L= 1786.51.
MODEL CHI-SQUARE= 145.54 WITH 10 D.F. (-2 LOG L.R.) P=0.0 .

VARIABLE	BETA	STD. ERROR	CHI-SQUARE	P	R
INTERCEPT	-3.00971102	0.99254421	9.19	0.0024	
INTRST	0.02743569	0.07769472	0.12	0.7240	0.000
SPREAD	0.12745293	0.24624303	0.27	0.6047	0.000
LOANAM	0.00001605	0.00000275	34.16	0.0000	0.129
FDIF	-0.00076580	0.00033836	5.12	0.0236	-0.040
INCOME	-0.00000679	0.00005505	0.02	0.9018	0.000
AGE	0.00763129	0.00593904	1.65	0.1988	0.000
SEX	0.14945596	0.19338725	0.60	0.4396	0.000
SPANISH	-0.18789145	0.25621290	0.54	0.4634	0.000
BLACK	0.30151122	0.34978808	0.74	0.3887	0.000
ASIAN	-0.03599476	0.17826268	0.04	0.8400	0.000

FRACTION OF CONCORDANT PAIRS OF PREDICTED PROBABILITIES AND RESPONSES 0.651
RANK CORRELATION BETWEEN PREDICTED PROBABILITY AND RESPONSE 0.328

Correlation Matrix - 1980 Sample 'AA'

	VRM	INTRST	SPREAD	LOANAM	INCOME	AGE	SEX	FDIF	SPANISH	BLACK	ASIAN
VRM	1.00000	0.00229	0.00907	0.28765	0.17854	0.05809	0.04393	-0.24087	-0.06602	-0.00010	-0.00548
	0.0000	0.9247	0.7085	0.0001	0.0001	0.0166	0.0701	0.0001	0.0064	0.9968	0.8212
INTRST	0.00229	1.00000	-0.50922	0.03552	0.10518	0.01813	-0.01853	0.12089	0.03198	0.06636	-0.02541
	0.9247	0.0000	0.0001	0.1431	0.0001	0.4548	0.4450	0.0001	0.1873	0.0062	0.2949
SPREAD	0.00907	-0.50922	1.00000	-0.08058	-0.09355	0.00905	0.00210	-0.20369	0.00072	0.00559	0.04450
	0.7085	0.0001	0.0000	0.0009	0.0001	0.7092	0.9311	0.0001	0.9764	0.8178	0.0665
LOANAM	0.28765	0.03552	-0.08058	1.00000	0.60883	0.08235	0.09987	-0.67249	-0.19698	-0.07626	0.00221
	0.0001	0.1431	0.0009	0.0000	0.0001	0.0007	0.0001	0.0001	0.0001	0.0016	0.9275
INCOME	0.17854	0.10518	-0.09355	0.60883	1.00000	0.18639	0.09779	-0.41364	-0.16104	-0.07062	-0.05162
	0.0001	0.0001	0.0001	0.0001	0.0000	0.0001	0.0001	0.0001	0.0001	0.0036	0.0333
AGE	0.05809	0.01313	0.00905	0.08235	0.18639	1.00000	0.03523	-0.08177	0.00035	-0.01031	0.00174
	0.0166	0.4548	0.7092	0.0007	0.0001	0.0000	0.1464	0.0007	0.9884	0.6709	0.9427
SEX	0.04393	-0.01853	0.00210	0.09987	0.09779	0.03523	1.00000	-0.09699	0.02640	-0.04202	0.01809
	0.0701	0.4450	0.9311	0.0001	0.0001	0.1464	0.0000	0.0001	0.2766	0.0832	0.4559
FDIF	-0.24087	0.12089	-0.20369	-0.67249	-0.41364	-0.08177	-0.09699	1.00000	0.13699	0.07619	-0.00199
	0.0001	0.0001	0.0001	0.0001	0.0001	0.0007	0.0001	0.0000	0.0001	0.0017	0.9346
SPANISH	-0.06602	0.03198	0.00072	-0.19698	-0.16104	0.00035	0.02640	0.13699	1.00000	-0.05141	-0.11064
	0.0064	0.1873	0.9764	0.0001	0.0001	0.9884	0.2766	0.0001	0.0000	0.0340	0.0001
BLACK	-0.00010	0.06636	0.00559	-0.07626	-0.07062	-0.01031	-0.04202	0.07619	-0.05141	1.00000	-0.06652
	0.9968	0.0062	0.8178	0.0016	0.0036	0.6709	0.0832	0.0017	0.0340	0.0000	0.0061
ASIAN	-0.00548	-0.02541	0.04450	0.00221	-0.05162	0.00174	0.01809	-0.00199	-0.11064	-0.06652	1.00000
	0.8212	0.2949	0.0665	0.9275	0.0333	0.9427	0.4559	0.9346	0.0001	0.0061	0.0000

Descriptive Statistics - 1980 Sample 'AA'

VARIABLE	N	MEAN	STANDARD DEVIATION	MINIMUM VALUE	MAXIMUM VALUE	STD ERROR OF MEAN	SUM	VARIANCE	C.V.
VRM=0									
INTRST	1267	12.1465864	0.8546839	8.750000	14.25000	0.02401138	15389.725	0.73	7.036
SPREAD	1267	-0.0669212	0.2903340	-0.362100	0.52240	0.00815661	-84.789	0.08	-433.844
LOANAM	1267	71196.4082134	26903.4934187	10158.730159	238095.23810	755.82346262	90205849.206	723797958.13	37.788
INCOME	1267	2438.0852157	1209.3742957	436.507937	6904.76190	33.97601395	3089053.968	1462586.19	49.603
AGE	1267	36.2872928	10.0427768	19.000000	70.00000	0.28214055	45976.000	100.86	27.676
SEX	1267	0.8729282	0.3331849	0.000000	1.00000	0.00936046	1106.000	0.11	38.169
FDIF	1267	150.1957005	191.9688723	-592.063492	670.16667	5.39315008	190297.953	36852.05	127.812
SPANISH	1267	0.0891871	0.2851261	0.000000	1.00000	0.00801030	113.000	0.08	319.694
BLACK	1267	0.0299921	0.1706328	0.000000	1.00000	0.00479374	38.000	0.03	568.926
ASIAN	1267	0.1262826	0.3322987	0.000000	1.00000	0.00933556	160.000	0.11	263.139
VRM=1									
INTRST	434	12.1511521	0.9089425	9.750000	14.00000	0.0436306	5273.600	0.8	7.480
SPREAD	434	-0.0608864	0.2898845	-0.362100	0.52240	0.0139149	-26.425	0.1	-476.107
LOANAM	434	92494.8796723	40474.6924597	16666.666667	238095.23810	1942.8474102	40142777.778	1638200729.7	43.759
INCOME	434	2976.2416795	1513.3766218	596.825397	6984.12698	72.6444025	1291688.889	2290308.8	50.849
AGE	434	37.6290323	10.1037658	13.000000	69.00000	0.4849963	16331.000	102.1	26.851
SEX	434	0.9055300	0.2928191	0.000000	1.00000	0.0140558	393.000	0.1	32.337
FDIF	434	24.1660193	291.1741135	-893.293651	670.16667	13.9768047	10488.052	84782.4	1204.891
SPANISH	434	0.0483871	0.2148305	0.000000	1.00000	0.0103122	21.000	0.0	443.983
BLACK	434	0.0299539	0.1706569	0.000000	1.00000	0.0081918	13.000	0.0	569.732
ASIAN	434	0.1221198	0.3278020	0.000000	1.00000	0.0157350	53.000	0.1	268.427

Logistic Regression (Restricted) - Pooled Time-Series Cross-Section Sample 'A'

DEPENDENT VARIABLE: VRM

2050 OBSERVATIONS
1497 VRM = 0
553 VRM = 1
0 OBSERVATIONS DELETED DUE TO MISSING VALUES

VARIABLE	MEAN	MINIMUM	MAXIMUM	RANGE
INTRST	11.8812	7.5	18	10.5
SPREAD	-0.149322	-0.99	2.1091	3.0991
LOANAM	67362.4	13416.8	250000	236583
FDIF	151.216	-1579.35	3624.44	5203.79
INCOME	2345.13	400	6937.77	6537.77
AGE	37.2556	19	75	56
SEX	0.879024	0	1	1
SPANISH	0.0731707	0	1	1
BLACK	0.0409756	0	1	1*
ASIAN	0.12439	0	1	1
SRIAEI	8.93395	6.9	10.4	3.5
TBDIF	.00905342	-2.06	2.09	4.15

* WARNING: VARIABLE HAS LIMITED DISPERSION.
IT MAY BE A BAD CANDIDATE FOR THE MODEL.

-2 LOG LIKELIHOOD FOR MODEL CONTAINING INTERCEPT ONLY= 2390.37

MODEL CHI-SQUARE= 206.70 WITH 12 D.F. (SCORE STAT.) P=0.0 .
CONVERGENCE OBTAINED IN 5 ITERATIONS. R= 0.277.
MAX ABSOLUTE DERIVATIVE=0.3732D-02. -2 LOG L= 2183.28.
MODEL CHI-SQUARE= 207.09 WITH 12 D.F. (-2 LOG L.R.) P=0.0 .

VARIABLE	BETA	STD. ERROR	CHI-SQUARE	P	R
INTERCEPT	-0.46247248	0.91891869	0.25	0.6148	
INTRST	-0.03531321	0.04458681	0.63	0.4284	0.000
SPREAD	0.85397474	0.15377991	30.84	0.0000	0.110
LOANAM	0.00001532	0.00000218	49.44	0.0000	0.141
FDIF	-0.00055066	0.00013018	17.89	0.0000	-0.082
INCOME	0.00006244	0.00005211	1.44	0.2308	0.000
AGE	0.00056267	0.00490753	1.79	0.1811	0.000
SEX	-0.12078836	0.16343056	0.55	0.4609	0.000
SPANISH	-0.14488620	0.22533300	0.41	0.5202	0.000
BLACK	-0.16838746	0.28644302	0.35	0.5566	0.000
ASIAN	-0.24840202	0.16624558	2.27	0.1351	-0.010
SRIAEI	-0.14300838	0.05292293	7.30	0.0069	-0.047
TBDIF	-0.21829455	0.03652901	35.71	0.0000	-0.119

Logistic Regression (Unrestricted) - Pooled Time-Series Cross-Section Sample 'A'

DEPENDENT VARIABLE: VRM

2050 OBSERVATIONS
1497 VRM = 0
553 VRM = 1
0 OBSERVATIONS DELETED DUE TO MISSING VALUES

VARIABLE	MEAN	MINIMUM	MAXIMUM	RANGE
INTRST	11.8812	7.5	18	10.5
SPREAD	-0.149322	-0.99	2.1091	3.0991
LOANAM	67362.4	13416.8	250000	236583
FDIF	151.216	-1579.35	3624.44	5203.79
INCOME	2345.13	400	6937.77	6537.77
AGE	37.2556	19	75	56
SEX	0.879024	0	1	1
SPANISH	0.0731707	0	1	1
BLACK	0.0409756	0	1	1*
ASIAN	0.12439	0	1	1
SRIAEI	8.93395	6.9	10.4	3.5
TBDIF	0.00905342	-2.06	2.09	4.15
Y81	0.242927	0	1	1

* WARNING: VARIABLE HAS LIMITED DISPERSION.
IT MAY BE A BAD CANDIDATE FOR THE MODEL.

-2 LOG LIKELIHOOD FOR MODEL CONTAINING INTERCEPT ONLY= 2390.37

MODEL CHI-SQUARE= 206.74 WITH 13 D.F. (SCORE STAT.) P=0.0 .
CONVERGENCE OBTAINED IN 5 ITERATIONS. R= 0.275.
MAX ABSOLUTE DERIVATIVE=0.5409D-02. -2 LOG L= 2183.20.
MODEL CHI-SQUARE= 207.16 WITH 13 D.F. (-2 LOG L.R.) P=0.0 .

VARIABLE	BETA	STD. ERROR	CHI-SQUARE	P	R
INTERCEPT	-0.11755470	1.53414645	0.01	0.9389	
INTRST	-0.03899517	0.04648462	0.70	0.4015	0.000
SPREAD	0.84941922	0.15447872	30.23	0.0000	0.109
LOANAM	0.00001521	0.00000222	46.99	0.0000	0.137
FDIF	-0.00054862	0.00013052	17.67	0.0000	-0.081
INCOME	0.00000344	0.00005222	1.48	0.2244	0.000
AGE	0.00654798	0.00490658	1.78	0.1820	0.000
SEX	-0.11913654	0.16353135	0.53	0.4663	0.000
SPANISH	-0.14447315	0.22531268	0.41	0.5214	0.000
BLACK	-0.16753688	0.28651578	0.34	0.5587	0.000
ASIAN	-0.25063483	0.16638738	2.27	0.1320	-0.011
SRIAEI	-0.17310729	0.11956827	2.10	0.1477	-0.006
TBDIF	-0.23175892	0.06035944	14.74	0.0001	-0.073
Y81	-0.11854550	0.42230573	0.08	0.7789	0.000

FRACTION OF CONCORDANT PAIRS OF PREDICTED PROBABILITIES AND RESPONSES :0.694
RANK CORRELATION BETWEEN PREDICTED PROBABILITY AND RESPONSE :0.407

Correlation Matrix - Pooled Time-Series Cross-Section Sample 'A'

CORRELATION COEFFICIENTS / PROB > |R| UNDER HO:RHO=0 / N = 2050

	VRM	INTRST	SPREAD	LOANAM	INCOME	AGE	SEX	SRIAEI	TBDIF	FDIF	SPANISH	BLACK	ASIAN	Y81
VRM	1.00000	0.02390	0.13275	0.20969	0.14795	0.03506	0.00303	-0.01450	-0.08905	-0.13640	-0.04416	-0.02583	-0.01927	0.02732
	0.0000	0.2794	0.0001	0.0001	0.0001	0.1125	0.8909	0.5119	0.0001	0.0001	0.0456	0.2423	0.3831	0.2162
INTRST	0.02390	1.00000	-0.38745	-0.01868	0.12973	-0.00376	-0.00726	-0.69557	-0.56648	0.45921	0.00556	0.03095	0.01454	0.68684
	0.2794	0.0000	0.0001	0.3978	0.0001	0.8649	0.7426	0.0001	0.0001	0.0001	0.8014	0.1613	0.5105	0.0001
SPREAD	0.13275	-0.38745	1.00000	-0.01536	-0.08006	-0.04454	-0.00454	0.33825	0.26788	-0.53419	0.04212	-0.00482	0.04801	-0.38965
	0.0001	0.0001	0.0000	0.4870	0.0003	0.0438	0.8371	0.0001	0.0001	0.0001	0.0565	0.8272	0.0297	0.0001
LOANAM	0.20969	-0.01868	-0.01536	1.00000	0.59847	0.02515	0.13105	0.05331	0.11636	-0.07183	-0.16119	-0.07633	0.04957	-0.15424
	0.0001	0.3978	0.4870	0.0000	0.0001	0.2551	0.0001	0.0158	0.0001	0.0011	0.0001	0.0005	0.0248	0.0001
INCOME	0.14795	0.12973	-0.08006	0.59847	1.00000	0.13111	0.09097	-0.03312	0.00725	0.05161	-0.13849	-0.06820	-0.06875	-0.00870
	0.0001	0.0001	0.0003	0.0001	0.0000	0.0001	0.0001	0.1339	0.7427	0.0195	0.0001	0.0020	0.0018	0.6938
AGE	0.03506	-0.00376	-0.04454	0.02515	0.13111	1.00000	-0.07441	0.00082	-0.01753	0.03801	-0.03828	-0.00101	-0.05034	0.00996
	0.1125	0.8649	0.0438	0.2551	0.0001	0.0000	0.0007	0.9705	0.4277	0.0853	0.0831	0.9637	0.0227	0.6522
SEX	0.00303	-0.00726	-0.00454	0.13105	0.09097	-0.07441	1.00000	0.02636	0.03049	0.00949	0.04679	-0.07424	0.00385	-0.03054
	0.8909	0.7426	0.8371	0.0001	0.0001	0.0007	0.0000	0.2328	0.1677	0.6677	0.0341	0.0008	0.8618	0.1670
SRIAEI	-0.01450	-0.69557	0.33825	0.05331	-0.03312	0.00082	0.02636	1.00000	0.32909	-0.44091	0.02713	-0.03902	-0.00811	-0.85970
	0.5119	0.0001	0.0001	0.0158	0.1339	0.9705	0.2328	0.0000	0.0001	0.0001	0.2196	0.0773	0.7135	0.0001
TBDIF	-0.08905	-0.56648	0.26788	0.11636	0.00725	-0.01753	0.03049	0.32909	1.00000	-0.24109	0.00898	-0.00425	0.00714	-0.65683
	0.0001	0.0001	0.0001	0.0001	0.7427	0.4277	0.1677	0.0001	0.0000	0.0001	0.6846	0.8476	0.9229	0.0001
FDIF	-0.13640	0.45921	-0.53419	-0.07183	0.05161	0.03801	0.00949	-0.44091	-0.24109	1.00000	0.00287	0.03969	-0.00250	0.45134
	0.0001	0.0001	0.0001	0.0011	0.0195	0.0853	0.6677	0.0001	0.0001	0.0000	0.8966	0.0724	0.9099	0.0001
SPANISH	-0.04416	0.00556	0.04212	-0.16119	-0.13849	-0.03828	0.04679	0.02713	0.00898	0.00287	1.00000	-0.05808	-0.10590	-0.01939
	0.0456	0.8014	0.0565	0.0001	0.0001	0.0831	0.0341	0.2196	0.6846	0.8966	0.0000	0.0085	0.0001	0.3803
BLACK	-0.02583	0.03095	-0.00482	-0.07633	-0.06820	-0.00101	-0.07424	-0.03902	-0.00425	0.03969	-0.05808	1.00000	-0.07791	0.03784
	0.2423	0.1613	0.8272	0.0005	0.0020	0.9637	0.0008	0.0773	0.8476	0.0724	0.0085	0.0000	0.0004	0.0868
ASIAN	-0.01927	0.01454	0.04801	0.04957	-0.06875	-0.05034	0.00385	-0.00811	0.00714	-0.00250	-0.10590	-0.07791	1.00000	-0.02049
	0.3831	0.5105	0.0297	0.0248	0.0018	0.0227	0.8618	0.7135	0.9229	0.9099	0.0001	0.0004	0.0000	0.3537
Y81	0.02732	0.68684	-0.38965	-0.15424	-0.00870	0.00996	-0.03054	-0.85970	-0.65683	0.45134	-0.01939	0.03784	-0.02049	1.00000
	0.2162	0.0001	0.0001	0.0001	0.6938	0.6522	0.1670	0.0001	0.0001	0.0001	0.3803	0.0868	0.3537	0.0000

Descriptive Statistics - Pooled Time-Series Cross-Section Sample 'A'

VARIABLE	N	MEAN	STANDARD DEVIATION	MINIMUM VALUE	MAXIMUM VALUE	STD ERROR OF MEAN	SUM	VARIANCE	C.V.
VRM=0									
INTRST	1497	11.8523480	2.1148399	7.500000	18.00000	0.05465962	17742.965	4.47	17.843
SPREAD	1497	-0.1812681	0.4335750	-0.990000	2.10910	0.01120607	-271.358	0.19	-239.190
LOANAM	1497	63425.9808060	26217.6451992	13416.815742	214592.27468	677.61464201	94948693.267	687364919.79	41.336
INCOME	1497	2232.2243113	1185.7366488	400.000000	6937.76824	30.64625021	3341639.794	1405971.40	53.119
AGE	1497	37.0227121	10.8543846	19.000000	75.00000	0.28053969	55423.000	117.82	29.318
SEX	1497	0.8784235	0.3269052	0.000000	1.00000	0.00844911	1315.000	0.11	37.215
YEAR	1497	79.4281897	1.1342181	78.000000	81.00000	0.02931472	118904.000	1.29	1.428
SRIAEI	1497	8.9457582	1.3221012	6.900000	10.40000	0.03417069	13391.800	1.75	14.779
TBDIF	1497	0.1056313	1.7950859	-2.060000	2.09000	0.04639534	158.130	3.22	1699.389
FDIF	1497	194.0981770	564.2542741	-818.166369	3624.44206	14.58357358	290564.971	318382.89	290.706
SPANISH	1497	0.0801603	0.2716320	0.000000	1.00000	0.00702053	120.000	0.07	338.861
BLACK	1497	0.0440882	0.2053596	0.000000	1.00000	0.00530767	66.000	0.04	465.793
ASIAN	1497	0.1282565	0.3344869	0.000000	1.00000	0.00864507	192.000	0.11	260.795
VRM=1									
INTRST	553	11.9593128	1.5883675	9.750000	17.25000	0.0675443	6613.500	2.5	13.281
SPREAD	553	-0.0628436	0.2498421	-0.990000	0.52240	0.0106244	-34.752	0.1	-397.562
LOANAM	553	78018.4097173	39040.4101952	17889.087657	250000.00000	1660.1671130	43144180.574	1524153628.2	50.040
INCOME	553	2650.7639153	1384.2933734	575.107296	6877.77778	58.8661421	1465872.445	1916268.1	52.222
AGE	553	37.8860759	11.1236319	20.000000	72.00000	0.4730249	20951.000	123.7	29.361
SEX	553	0.8806510	0.3244923	0.000000	1.00000	0.0137988	487.000	0.1	36.847
YEAR	553	79.5895118	1.0647678	78.000000	81.00000	0.0452785	44013.000	1.1	1.338
SRIAEI	553	8.9019892	1.3898101	6.900000	10.40000	0.0591007	4922.800	1.9	15.612
TBDIF	553	-0.2523870	1.7314996	-2.060000	2.09000	0.0736309	-139.570	3.0	-686.050
FDIF	553	35.1308377	335.2446185	-1579.347048	2222.08155	14.2560513	19427.353	112389.0	954.274
SPANISH	553	0.0542495	0.2267145	0.000000	1.00000	0.0096409	30.000	0.1	417.910
BLACK	553	0.0325497	0.1776156	0.000000	1.00000	0.0075530	18.000	0.0	545.675
ASIAN	553	0.1139241	0.3180067	0.000000	1.00000	0.0135230	63.000	0.1	279.139

Logistic Regression (Restricted) - Pooled Time-Series Cross-Section Sample 'AA'

DEPENDENT VARIABLE: VRM

2009 OBSERVATIONS
1474 VRM = 0
535 VRM = 1
0 OBSERVATIONS DELETED DUE TO MISSING VALUES

VARIABLE	MEAN	MINIMUM	MAXIMUM	RANGE
INTRST	11.9066	7.75	18	10.25
SPREAD	-0.146146	-0.99	2.1091	3.0991
LOANAM	66582.4	10158.7	268336	258178
FDIF	161.522	-1807.7	3624.44	5432.14
INCOME	2365.64	425	7000	6575
AGE	37.2494	19	73	54
SEX	0.879044	0	1	1
SPANISH	0.0876058	0	1	1
BLACK	0.039323	0	1	1*
ASIAN	0.107516	0	1	1
SRIAEI	8.90174	6.9	10.4	3.5
TBDIF	0.0357339	-2.06	2.09	4.15

* WARNING: VARIABLE HAS LIMITED DISPERSION.
IT MAY BE A BAD CANDIDATE FOR THE MODEL.

-2 LOG LIKELIHOOD FOR MODEL CONTAINING INTERCEPT ONLY= 2328.61

MODEL CHI-SQUARE= 208.25 WITH 12 D.F. (SCORE STAT.) P=0.0 .
CONVERGENCE OBTAINED IN 5 ITERATIONS. R= 0.283.
MAX ABSOLUTE DERIVATIVE=0.1072D-01. -2 LOG L= 2118.68.
MODEL CHI-SQUARE= 209.93 WITH 12 D.F. (-2 LOG L.R.) P=0.0 .

VARIABLE	BETA	STD. ERROR	CHI-SQUARE	P	R
INTERCEPT	-0.43627795	0.92771729	0.22	0.6382	
INTRST	-0.06814089	0.04534378	2.26	0.1329	-0.011
SPREAD	1.12446052	0.17284277	42.32	0.0000	0.132
LOANAM	0.00001623	0.00000222	53.41	0.0000	0.149
FDIF	-0.00038413	0.00013309	8.22	0.0041	-0.052
INCOME	-0.00000660	0.00005287	0.01	0.9025	0.000
AGE	0.00766222	0.00509194	2.26	0.1324	0.011
SEX	0.08099011	0.17052127	0.23	0.6348	0.000
SPANISH	0.03442104	0.14948736	0.05	0.8630	0.000
BLACK	0.11244649	0.28842918	0.15	0.6966	0.000
ASIAN	-0.30859034	0.18209769	2.87	0.0901	-0.019
SRIAEI	-0.11690184	0.05375670	4.80	0.0285	-0.035
TBDIF	-0.27183546	0.03727931	53.17	0.0000	-0.148

Logistic Regression (Unrestricted) - Pooled Time-Series Cross-Section Sample 'AA'

DEPENDENT VARIABLE: VRM

2009 OBSERVATIONS
1474 VRM = 0
535 VRM = 1
0 OBSERVATIONS DELETED DUE TO MISSING VALUES

VARIABLE	MEAN	MINIMUM	MAXIMUM	RANGE
INTRST	11.9066	7.75	18	10.25
SPREAD	-0.146146	-0.99	2.1091	3.0991
LOANAM	66582.4	10158.7	268336	258178
FDIF	161.522	-1807.7	3624.44	5432.14
INCOME	2365.64	425	7000	6575
AGE	37.2494	19	73	54
SEX	0.879044	0	1	1
SPANISH	0.0876058	0	1	1
BLACK	0.039323	0	1	1*
ASIAN	0.107516	0	1	1
SRIAEI	8.90174	6.9	10.4	3.5
TBDIF	0.0357339	-2.06	2.09	4.15
YB1	0.247885	0	1	1

* WARNING: VARIABLE HAS LIMITED DISPERSION.
IT MAY BE A BAD CANDIDATE FOR THE MODEL.

-2 LOG LIKELIHOOD FOR MODEL CONTAINING INTERCEPT ONLY= 2328.61

MODEL CHI-SQUARE= 210.21 WITH 13 D.F. (SCORE STAT.) P=0.0 .
CONVERGENCE OBTAINED IN 5 ITERATIONS. R= 0.282.
MAX ABSOLUTE DERIVATIVE=0.1062D-01. -2 LOG L= 2117.51.
MODEL CHI-SQUARE= 211.10 WITH 13 D.F. (-2 LOG L.R.) P=0.0 .

VARIABLE	BETA	STD. ERROR	CHI-SQUARE	P	R
INTERCEPT	-1.77791438	1.54928856	1.32	0.2511	
INTRST	-0.05345337	0.04727415	1.28	0.2582	0.000
SPREAD	1.14773556	0.17516483	42.93	0.0000	0.133
LOANAM	0.00001655	0.00000225	54.34	0.0000	0.150
FDIF	-0.00039072	0.00013370	8.54	0.0035	-0.053
INCOME	-0.00000964	0.00005399	0.03	0.8583	0.000
AGE	0.00750591	0.00509533	2.28	0.1309	0.011
SEX	0.08238480	0.17065153	0.23	0.6293	0.000
SPANISH	0.04180721	0.19973246	0.04	0.8342	0.000
BLACK	0.10939931	0.28815634	0.14	0.7042	0.000
ASIAN	-0.30614706	0.18229170	2.82	0.0931	-0.019
SRIAEI	-0.00023804	0.12036918	0.00	0.9984	0.000
TBDIF	-0.22014303	0.06034898	13.31	0.0003	-0.070
YB1	0.45935070	0.42470193	1.17	0.2794	0.000

FRACTION OF CONCORDANT PAIRS OF PREDICTED PROBABILITIES AND RESPONSES :0.708
RANK CORRELATION BETWEEN PREDICTED PROBABILITY AND RESPONSE :0.434

Correlation Matrix -
Pooled Time-Series Cross-Section
Sample 'AA'

CORRELATION COEFFICIENTS / PROB > |R| UNDER HO:RHO=0 / N = 2009

	VRM	INTRST	SPREAD	LOANAM	INCOME	AGE	SEX	SRIAEI	TBDIF	FDIF	SPANISH	BLACK	ASIAN	YB1
VRM	1.00000 0.0000	-0.00138 0.9506	0.16233 0.0001	0.19049 0.0001	0.10223 0.0001	0.04040 0.0702	0.02663 0.2328	0.00907 0.6845	-0.10763 0.0001	-0.13230 0.0001	-0.02338 0.2950	-0.01760 0.4304	-0.02734 0.2206	0.03229 0.1479
INTRST	-0.00138 0.9506	1.00000 0.0000	-0.41681 0.0001	-0.03790 0.0895	0.11518 0.0001	-0.00950 0.6705	0.00064 0.9770	-0.69984 0.0001	-0.57282 0.0001	0.46433 0.0001	-0.01747 0.4339	0.03178 0.1545	0.03075 0.1683	0.68586 0.0001
SPREAD	0.16233 0.0001	-0.41681 0.0001	1.00000 0.0000	0.00044 0.9844	-0.08301 0.0002	-0.02660 0.2334	0.00955 0.6687	0.35519 0.0001	0.28435 0.0001	-0.56009 0.0001	0.01597 0.4743	-0.04388 0.0492	0.01906 0.3933	-0.40958 0.0001
LOANAM	0.19049 0.0001	-0.03790 0.0895	0.00044 0.9844	1.00000 0.0000	0.59106 0.0001	0.04627 0.0381	0.11801 0.0001	0.06748 0.0025	0.11326 0.0001	-0.05760 0.0098	-0.14516 0.0001	-0.10803 0.0001	0.02237 0.3163	-0.14247 0.0001
INCOME	0.10223 0.0001	0.11518 0.0001	-0.08301 0.0002	0.59106 0.0001	1.00000 0.0000	0.16900 0.0001	0.12584 0.0001	-0.02346 0.2933	0.02665 0.2325	0.06041 0.0068	-0.12706 0.0001	-0.09317 0.0001	-0.05000 0.0250	-0.01799 0.4203
AGE	0.04040 0.0702	-0.00950 0.6705	-0.02660 0.2334	0.04627 0.0381	0.16900 0.0001	1.00000 0.0000	-0.00564 0.8005	0.00372 0.8676	-0.01722 0.4404	0.04719 0.0344	-0.02491 0.2644	-0.02010 0.3678	-0.04263 0.0561	0.01068 0.6323
SEX	0.02663 0.2328	0.00064 0.9770	0.00955 0.6687	0.11801 0.0001	0.12584 0.0001	-0.00564 0.8005	1.00000 0.0000	0.01316 0.5556	0.03181 0.1541	0.01597 0.4743	0.04475 0.0449	-0.07418 0.0009	-0.00923 0.6792	-0.03098 0.1651
SRIAEI	0.00907 0.6845	-0.69984 0.0001	0.35519 0.0001	0.06748 0.0025	-0.02346 0.2933	0.00372 0.8676	0.01316 0.5556	1.00000 0.0000	0.35161 0.0001	-0.44905 0.0001	0.04740 0.0336	-0.02574 0.2488	-0.01980 0.3750	-0.85957 0.0001
TBDIF	-0.10763 0.0001	-0.57282 0.0001	0.28435 0.0001	0.11326 0.0001	0.02665 0.2325	-0.01722 0.4404	0.03181 0.1541	0.35161 0.0001	1.00000 0.0000	-0.22527 0.0001	0.00949 0.6708	-0.03178 0.1545	-0.01224 0.5834	-0.67267 0.0001
FDIF	-0.13230 0.0001	0.46433 0.0001	-0.56009 0.0001	-0.05760 0.0098	0.06041 0.0068	0.04719 0.0344	0.01597 0.4743	-0.44905 0.0001	-0.22527 0.0001	1.00000 0.0000	-0.01742 0.4353	0.05365 0.0162	0.00250 0.9108	0.44329 0.0001
SPANISH	-0.02338 0.2950	-0.01747 0.4339	0.01597 0.4743	-0.14516 0.0001	-0.12706 0.0001	-0.02491 0.2644	0.04475 0.0449	0.04740 0.0336	0.00949 0.6708	-0.01742 0.4353	1.00000 0.0000	-0.06269 0.0049	-0.10755 0.0001	-0.04741 0.0336
BLACK	-0.01760 0.4304	0.03178 0.1545	-0.04388 0.0492	-0.10803 0.0001	-0.09317 0.0001	-0.02010 0.3678	-0.07418 0.0009	-0.02574 0.2488	-0.03178 0.1545	0.05365 0.0162	-0.06269 0.0049	1.00000 0.0000	-0.07022 0.0016	0.04399 0.0487
ASIAN	-0.02734 0.2206	0.03075 0.1683	0.01906 0.3933	0.02237 0.3163	-0.05000 0.0250	-0.04263 0.0561	-0.00923 0.6792	-0.01980 0.3750	-0.01224 0.5834	0.00250 0.9108	-0.10755 0.0001	-0.07022 0.0016	1.00000 0.0000	0.00914 0.6821
YB1	0.03229 0.1479	0.68586 0.0001	-0.40958 0.0001	-0.14247 0.0001	-0.01799 0.4203	0.01068 0.6323	-0.03098 0.1651	-0.85957 0.0001	-0.67267 0.0001	0.44329 0.0001	-0.04741 0.0336	0.04399 0.0487	0.00914 0.6821	1.00000 0.0000

Descriptive Statistics -
Pooled Time-Series Cross-Section
Sample 'AA'

VARIABLE	N	MEAN	STANDARD DEVIATION	MINIMUM VALUE	MAXIMUM VALUE	STD ERROR OF MEAN	SUM	VARIANCE	C.V.
VRM=0									
INTRST	1474	11.9087870	2.1072869	7.750000	18.00000	0.05488769	17552.815	4.44	17.696
SPREAD	1474	-0.1839151	0.4161791	-0.990000	2.10910	0.01084006	-271.091	0.17	-226.289
LOANAM	1474	63054.0266848	25781.6802974	10158.730159	214592.27468	671.52545058	92941635.333	664695038.96	40.888
INCOME	1474	2287.4171048	1207.1407386	425.000000	6937.76824	31.44192772	3371652.812	1457188.76	52.773
AGE	1474	36.9898236	10.4771710	19.000000	73.00000	0.27289482	54523.000	109.77	28.324
SEX	1474	0.8738128	0.3321730	0.000000	1.00000	0.00865198	1288.000	0.11	38.014
YEAR	1474	79.4606513	1.1357959	78.000000	81.00000	0.02958364	117125.000	1.29	1.429
SRIAEI	1474	8.8944369	1.3103625	6.900000	10.40000	0.03413050	13110.400	1.72	14.732
TBDIF	1474	0.1517096	1.7911311	-2.060000	2.09000	0.04665290	223.620	3.21	1180.631
FDIF	1474	203.0028102	568.0967874	-742.682403	3624.44206	14.79699720	299226.142	322733.96	279.847
SPANISH	1474	0.0915875	0.2885407	0.000000	1.00000	0.00751551	135.000	0.08	315.044
BLACK	1474	0.0413840	0.1992443	0.000000	1.00000	0.00518964	61.000	0.04	481.453
ASIAN	1474	0.1126187	0.3162334	0.000000	1.00000	0.00823681	166.000	0.10	280.800
VRM=1									
INTRST	535	11.9020467	1.6490241	9.470000	17.25000	0.0712935	6367.595	2.7	13.855
SPREAD	535	-0.0420856	0.2617991	-0.990000	0.52240	0.0113186	-22.516	0.1	-622.063
LOANAM	535	76303.7845676	39922.5409475	16000.000000	268336.31485	1726.0019578	40822524.744	1593809275.7	52.321
INCOME	535	2581.1674084	1409.1311579	447.227191	7000.00000	60.9220525	1380924.564	1985650.6	54.593
AGE	535	37.9644860	11.1486656	21.000000	72.00000	0.4819988	20311.000	124.3	29.366
SEX	535	0.8934579	0.3088189	0.000000	1.00000	0.0133514	478.000	0.1	34.564
YEAR	535	79.5551402	1.0931549	78.000000	81.00000	0.0472612	42562.000	1.2	1.374
SRIAEI	535	8.9218692	1.4098198	6.900000	10.40000	0.0609518	4773.200	2.0	15.802
TBDIF	535	-0.2837944	1.7455088	-2.060000	2.09000	0.0754649	-151.830	3.0	-615.061
FDIF	535	47.2358930	333.0517267	-1807.701252	2222.08155	14.3990818	25271.203	110923.5	705.082
SPANISH	535	0.0766355	0.2662612	0.000000	1.00000	0.0115115	41.000	0.1	347.438
BLACK	535	0.0336449	0.1804820	0.000000	1.00000	0.0078029	18.000	0.0	536.433
ASIAN	535	0.0934579	0.2913455	0.000000	1.00000	0.0125960	50.000	0.1	311.740